THE AMERICAN GAS LIGHT JOURNAL

INC.

PUBLISHED WEEKLY, AT No. 42 PINE STREET.

VOLUME CI., No. 20.
Whole No. 2,058.

NEW YORK, MONDAY, NOVEMBER 16, 1914.

Subscription, $3 Per Year.
$4 Canada, $5 Foreign.

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Coal Gas Residuals—Feld Process.[1]

[Written for the Ninth Meeting, American Gas Institute by MR. F. H. WAGNER.]

A hundred years have passed since Murdock lighted the City of London with coal gas, and these years have placed gas lighting in the fore-front of industrial progress, while their history shows how the proper utilization of by-products can revolutionize an industry. The early years of coal carbonization could depend upon but little assistance from by-product sales in cheapening the cost of production, and not until modern chemistry was called in did residuals make any appreciable change in this condition.

The recovery of the residuals is a very important conservation of resources, and it is one of the principal means of revenue to the coal gas producer, their sale reducing the cost of gas production in a degree corresponding to the efficiency of the recovery methods adopted.

The principal residuals recovered to day are tar, napthalene, cyanogen compounds, ammonia and benzol, and they will be treated in this order in the following pages. The recovery of benzol is confined almost entirely to coke oven plants, where a direct method of recovery is adopted, and to the tar distiller. While the recovery of napthalene cannot exactly be termed one of profit in a pecuniary sense, its partial removal from the gas is of distinct advantage.

Gas produced by the carbonization of coal is a mixture of fixed gases, vapors of various kinds, and, at times, globules of liquids, held in suspension and carried forward by the gas. These gases also carry forward some solid carbon dust.

The principal fixed gases are hydrogen, H_2; methane, CH_4, "marsh gas;" ethane, C_2H_6; propane, C_3H_8; butane, C_4H_{10}; ethylene, C_2H_4; small amounts of butylene, C_4H_8; propylene, C_3H_6; acetylene, C_2H_2; carbon dioxide, CO_2; carbon monoxide, CO; hydrogen sulphide, H_2S; nitrogen, N; oxygen, O; and ammonia, NH_3. The principal vapors in the mixture are benzol, C_6H_6; toluol, $C_6H_5CH_3$; xylol, C_6H_4 $(CH_3)_2$ carbon disulphide, CS_2; and aqueous vapors. These vapors all pertain to substances which are liquid at ordinary tembut the vapors of napthalene, $C_{10}H_8$, phenols, etc., pertain to substances which become solid at ordinary temperatures, and must therefore, be subjected to special treatment.

Some of these constituents are of inestimable value to the coal gas producer, and consequently the treatment of the gas is of great importance, and should not only consist of a method of cooling the gas, and thus condensing and precipitating the vapors as a fluid, but the method of treatment should be such as to retain in the gas those valuable illuminating constituents which may be lost in the usual condensing plant.

The Feld system of condensation and purification of coal gas embraces successive cooling with a fractionation of the products. The usual condensing system in coal gas practice embraces a primary condenser, exhauster, tar extractor, secondary condenser, and ammonia washer; the tar, together with quite an amount of illuminants, being removed in a greater measure by cooling, while in the Feld system the gas is not cooled below a point where any volatile hydrocarbons are precipitated or absorbed by the effluent, the tar being fractionated in three washers into pitch, heavy oils, and middle or light oils, and the gas is treated for cyanogen compounds, combined hydrogen sulphide and ammonia, naphthalene, and finally benzol; the entire process carried out in Feld vertical centrifugal washers, as shown in Fig. 1.

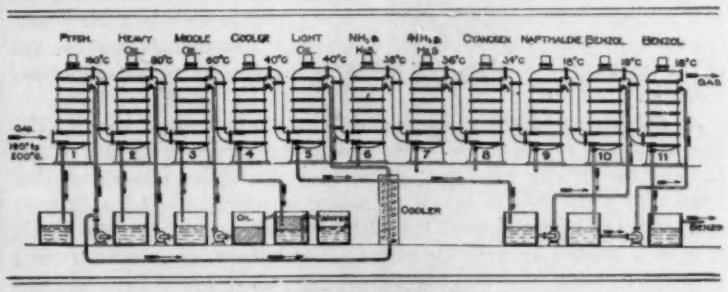


Fig. 1.—Feld Condensing Plant.

The entire condensing plant consists of eleven washers, the first, or pitch washer operating at a temperature of from 320° to 392° F., the gas being kept at this temperature from the hydraulic main by insulating the main and pipe connections, or by the application of external heat: heavy oils from washer (2) being pumped into washer (1) where they are used as the active pitch extracting medium.

Washer (2) removes the heavy oils, and is operated at 320° to 176° F., all operating temperatures being determined from the dew-point of the gas for the constituent to be removed, the extracting medium (2) being the middle oils from washer (3).

1. Slightly abridged.—EDS.

Washer (3) removes the middle oils, by contact between the gas and the oils separated by cooling in washer (4); this cooling effected by water the effluent from washer (4) being run into a separating tank where the oil is separated from the water.

The light oils are removed in (5), where the gases are washed by heavy oils previously cooled in a special cooler; the oils from (5) being run into a reservoir from whence they are pumped into the first benzol washer.

The washers for ammonia and hydrogen sulphide operate at from 104° to 97° F., the hydrogen sulphide being combined with the ammonia with the formation of ammonium sulphate. The cyanogen washer operates at about 97° to 93° F.

The naphthalene is removed in (9) at about 65° F.; while (10) and (11) extract the benzol and its homologues, the partially saturated oil from (10) being pumped into (11).

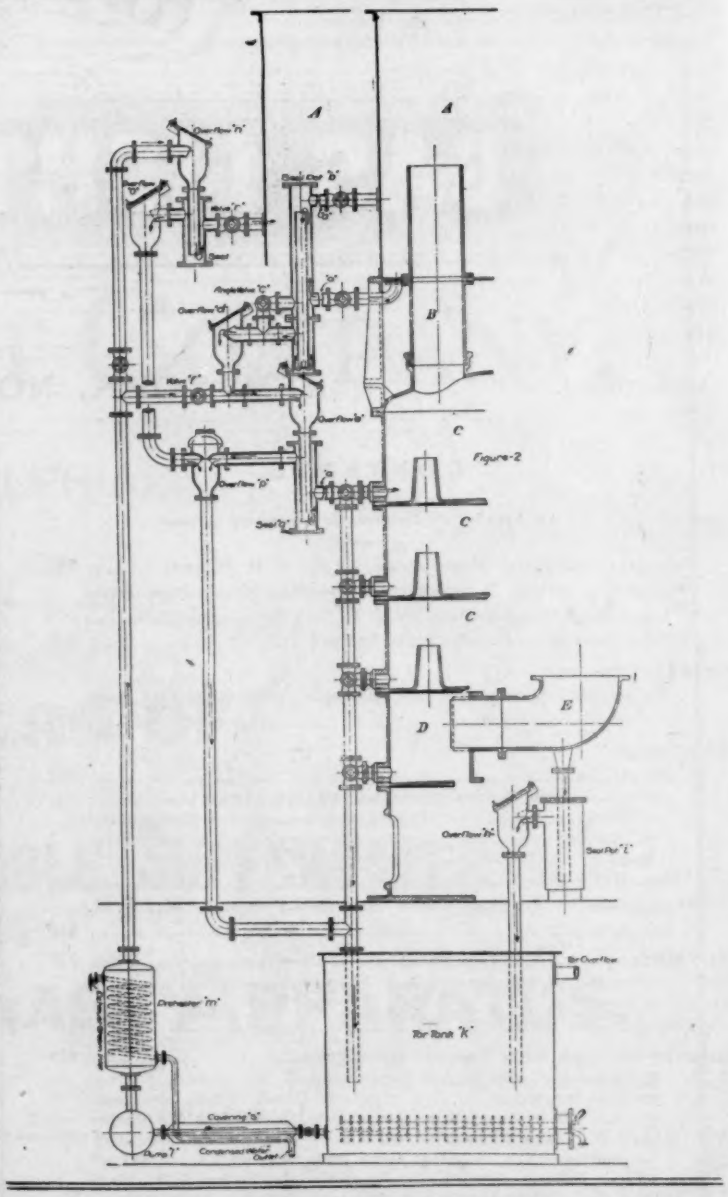
Tar.—Tar is a thick, dark brown, viscid, oily liquid, its chemical nature is very complex, and it contains a large number of compounds. The crude gas leaving the retorts carries with it a number of hydrocarbon and other vapors, and as the illuminating, as well as the calorific quality of coal gas depends upon its hydrocarbon constituents, it is of prime importance to so treat the gas as to retain as many of these hydrocarbons as possible. A reduction in temperature reduces the hydrocarbons of greater density to liquid form, and this liquid is usually termed "tar." In spite of the fact that the gas temperature at the hydraulic main is perhaps never lower than 145° F., large quantities of tar are deposited at this point, and it is, therefore, almost impossible to retain the hydrocarbons of this class in the gas with the usual method of condensation.

The nature of the coal and the temperature of carbonization exercise a great influence upon the quantity and quality of tar produced, and govern to a great extent, the final cost of gas production.

In the systems applied at present, the removal or the precipitation of tar is accomplished by cooling; quite an amount of condensation occurs between the retort and the hydraulic main, a further amount of tar being deposited in the hydraulic main proper, after which the gas goes to the condensers, where gradual cooling further reduces the tar content. After leaving the condensers, the gas still contains tar globules in suspension, it being possible to remove these last traces only by friction.

In the Feld system, a different method is employed, the heat in the gas being utilized by a system of fractional coolings to separate, or wash out of the gas, tar in its principal constituents. The treatment may be varied to prevent the formation of tar as much as possible, by maintaining the gas coming from the retorts at a temperature above the dew-point of the gas for the constituents of high boiling points. This may be done by covering the connections from the retorts to the first washer with insulating material, or by applying heat to the exterior of the pipes, the gas being led to the washers where it is subjected to fractional cooling and successive washings at successively lower temperatures, so that the various tar constituents are separated from each other by employing the temperature of the gas, and without the necessity of employing extraneous heat after previous cooling.

A Feld washer arranged for hot tar washing is shown in Fig. 2; and in order that aqueous condensation may be avoided, the washing tar should be from 40° to 60° F. above the temperature of the gas at the inlet to the washer, this hot tar being the active tar extracting medium.



A, Pelouze Condenser; *B*, Gas port in washing chamber; *C*, Upper washing chamber; *D*, Lower washing chamber; *E*, Gas inlet; *k*, Tank containing wash tar; *r*, Steam coil; *l*, Tar pump; *m*, Preheater for wash tar; *s*, Insulated connection from *k* to *l*.

In order to keep the wash tar at the desired temperature the steam pipe *m* is located beneath the pipe *s*. The hot tar is pumped from *k* through *s* and *m* to *A* and through the overflow pot *n*; any surplus tar overflows at *O* and *p* and returns to tank *k*.

The tar overflows from *A* through *b* and *d*, *e* and *g*, into the upper chamber *C* of the washer, where it is picked up by the washing cones within the chamber and spread out over the entire gas space, the depth of the spray being from 8 inches to 14 inches, depending upon the size of the washer. The gas is thus brought into intimate contact with the hot wash tar, and is subjected to a thorough washing, the wash tar and the tar separated from the gas, overflowing through the gas port to the next lower washing chamber; here the wash tar is again circulated by the cones in the chamber, and the total combined tar finally leaves the washer through the pot *i* attached through the gas inlet connection, and by means of overflow *h* enters *k*; the surplus from this tank flowing to the tar storage. In order that the maximum results may be secured, the wash tar should be constantly circulated through the washer, but it is not always necessary to circulate it through the Pelouze condenser, this omission being dependent upon the condition of the tar in the gas. The amount of hot tar circulated may vary from 0.5 to 2.5 gallons per 1,000 cubic feet of gas per hour; larger volumes of gas require proportionally less circulating tar than smaller volumes, but the quantity of washing tar must be regulated to prevent the gas reducing the temperature of the wash tar. The wash tar should be pumped through the preheater *m* before it enters the washer, the preheater having a steam coil; and in some cases it may be necessary to insulate the tank containing the wash tar, and also have a steam coil, or radiator, made in one piece in order to prevent leaks and thus mixing water with the tar. Care must be exercised to prevent the deposit of thick tar in the Pelouze condenser, and if the washer should be stopped for any reason, it must be emptied of tar at once in order to avoid cooling the tar and clogging up the passages.

Table I. gives the results secured in washing with hot tar, the washer having a Pelouze condenser in one instance, but not in the other.

The Feld process of tar washing was installed in a works in Bohemia in 1907, and the tar was fractionated into pitch, heavy oil and light oil, with the result that the tar produced by the old method of condensation sold for $5.00 per ton; while with the Feld system producing the oils direct from the gas, the equivalent of this ton of tar sold for $16.00.

Naphthalene.—($C_{10}H_8$) is a hydrocarbon, melting at 174°, a boiling at 424° F., and it sublimes at lower temperatures. The deposition of solid naphthalene in the mains or apparatus causes many operating difficulties, as it decreases the cross-sectional area of the gas conduits, producing back pressure on the works. Its presence in the gas is

probably due to the high heats employed in present-day carbonization, causing a partial distillization of the tar with formation of naphthalene. The greater part of the naphthalene produced goes over into the tar, the gas containing only a portion of the naphthalene vapor, its maximum content depending upon saturation at various temperatures; but outside of the temperature of carbonization the naphthalene present in the gas is due to the character of the coal used and upon the time of contact between the gas and hot coke and retort walls. In order to avoid stoppages in the pipe connections due to sublimation, it would be necessary to cool the gas to a temperature corresponding to that of the gas in the buried mains, but as it is almost impossible to always do this, it becomes necessary to remove the naphthalene from the gas by a suitable extracting medium. The best solvents for this purpose are anthracene oil, creosote oil, and water gas tar; tar from vertical retorts has also been used, but it must first be subjected to complete cooling.

TABLE I.—*Feld Hot Tar Washing.—Washer Without Pelouze Condenser.*

Gas Temperature at Inlet to Washer.	Tar Content in Grains per Cu. Ft.		Grains Removed.	Efficiency per Cent.	Gas Passed per 24 Hrs. Cubic Feet.
	Inlet.	Outlet.			
131° F.	11.512	0.2930	11.219	97.46	2,463,000
127° F.	10.386	0.2160	10.170	97.92	2,453,832
129° F.	10.818	0.2930	10.525	97.29	2,341,800
129° 7.	13.518	0.4170	13.101	96.92	2,397,000
126° F.	9.907	0.5250	9.382	94.70	2,490,000
Washer With Pelouze Condenser.					
130° F.	10.050	0.0436	10.0064	99.56	2,600,000
194° F.	13.100	0.0872	13.0128	99.34	2,600,000

If all of the naphthalene were removed from the gas, the latter would suffer considerably in candle-power. and no more should be expelled than would produce sublimation with consequent stoppages. Under ordinary conditions, 100 grains of anthracene oil will absorb from 10 to 25 grains of naphthalene, according to temperature, but 3 to 4 per cent. of benzol should be added to the oil, this addition leading to greater extraction efficiency, which can be further increased by thoroughly and slowly cooling the gas, as the absorption is most complete at 60° to 70° F.

One per cent. of creosote oil will, under ordinary conditions, absorb one per cent. of naphthalene, by weight, but is dependent upon the amount of phenols present. Water gas tar will absorb from 18 to 20 per cent. of its weight in naphthalene, its efficiency depending upon the phenols present. If water gas tar or water gas oil is used it can be run back to storage bearing its naphthalene burden, as the latter is not detrimental to the further use of the tar or oil, but if anthracene or creosote oil is used they can be regenerated for further use by being distilled and condensed, the naphthalene crystalizing out.

Attempts have been made to use naphthalene as fuel in internal combustion engines with some success. The drawback seems to be that it is necessary to start the engine with gas or some liquid fuel, and to so operate it until hot enough to melt the naphthalene, after which the latter is fed to the engine, vaporized, and exploded. Success in this direction would give another source of revenue to products of coal.

Cyanogen.—Cyanogen (C_2N_2) is probably produced during carbonization in the form of hydrocyanic acid by the decomposition of some of the ammonia by contact with the hot coke in the retort, as per the equation,

$$C + NH_3 = HCN + H_2;$$

and the amount produced bears a certain relation to the nitrogen in the coal. The removal of cyanogen from coal gas is of advantage for two reasons: 1st, because of its corrosive effect on works apparatus, 2d, because it is a valuable by-product, and if permitted to pass into the purifiers, it will combine with the iron in the oxide rendering it inactive for hydrogen sulphide extracton. On the other hand, spent oxide containing a high percentage of cyanogen is more valuable than if it contained only sulphur, as it is often purchased on the basis of its "prussian blue" content, the cyanogen combination.

The revenue derived from the extraction of cyanogen from coal gas is not a remunerative proposition for works carbonizing less than 250 tons of coal per day, as the same labor expended on a plant of this size, can readily handle the proposition in one of double that capacity. The return for a plant carbonizing 250 tons of coal at one works, and 750 tons at another, the sludge from both being worked up one plant, deducting operating expenses, 6 per cent. interest and 6 per cent. for depreciation, amounts to $27,935 per year without the revenue from the production of ammonium sulphate from the cyanogen press liquor sold on the basis of concentrated ammonia. The extraction of cyanogen in this case shows the life of the oxide is increased 22 per cent.

The two systems of cyanogen recovery that have met with the most pronounced success, are that of Bueb and the one devised by Feld, the former making an insoluble ferro-cyanide coke, and the latter a soluble cyanide sludge.

The Feld process differs from the Bueb in that it is applied after the ammonia has been removed from the gas, this alkali being replaced by milk of lime in the copperas washing medium. The combined solution of lime and copperas is run into the Feld vertical washer, the resultant sludge from the bottom being boiled and then filter-pressed, the product being calcium ferro-cyanide. The product from a Bueb plant is usually worked up into potassium ferro-cyanide, but requires additional apparatus for the removal and concentration of the ammonia carried in the sludge.

Ammonia.—Ammonia results from the union of nitrogen with hydrogen, $N + H_3 = NH_3$; and besides being an important source of revenue, its removal from gas is necessary on account of its destructive influence on the brass and copper of meters and gas fittings; when burned in gas it gives off fumes of oxides of nitrogen. The usual method employed for the removal of ammonia depends upon its solubility in watar, at ordinary temperatures water absorbing about 708 times its volume of ammonia gas, the absorption increasing with a decrease in water temperature, or:

One volume of water at	32° F.	will absorb	1,050	volumes of	NH_3
" "	50° F.	"	813	"	"
" "	59° F.	"	727	"	"
" "	68° F.	"	654	"	"
" "	77° F.	"	586	"	"
" "	183° F.	"	180	"	"

if the pressure of the ammonia gas is equal to that of the atmosphere and the gas carries no tar.

In American gas works operation the ammonia is removed by condensation and washing, the first portion being removed in the hydraulic main, due to the condensation of water vapors, which absorb ammonia. Cooling the gas in the condensers also causes deposition of water which absorbs more ammonia, the final ammonia being removed in the scrubbers or mechanical washers, using as little wash water as is consistent with the result desired, *viz.*: strong liquor.

The raw ammonia liquor usually contains from 1 to 2 per cent. of ammonia, and is usually worked up for one of the following products:

1. Concentrated liquor,
2. Aqua ammonia,
3. Sulphate of ammonia;

the product recommended for any particular works depending upon local market conditions.

Concentrated ammonia is the raw liquor freed of a large portion of water, and it is used for producing other ammonia products. Aqua ammonia is a solution of ammonia in distilled water, used for cleansing purposes. Ammonia sulphate is produced by distilling the liquor, and absorbing in sulphuric acid, by passing the gas through an acid bath, or by combining the ammonia in the gas directly with the sulphur radical, discarding sulphuric acid.

The working up of the liquor is usually effected in continuous stills (Fig. 3), operating by live steam, and as the principal of operaeration is practically the same in all stills on the market, only one method will be described.

The still usually consists of a series of superimposed sections of cast iron; each section provided with a steam passage in the bottom covered with a hood or bell, and an internal overflow for liquor. The liquor having been heated, enters at the top of the still and flows from section to section; the steam enters at the bottom, passes up through the steam passages, and is made to pass through the liquor by means of hoods or bells. The liquor is thus gradually brought to the boiling point, the free ammonia and other gases mixing with the steam in the upper portion of the apparatus. Milk of lime is introduced in small quantities into the lower, or liming section, the hoods of these sections having a somewhat deeper seal than the others, in order to permit of more efficient mixing of lime and liquor. A final boiling of the liquor in the lower sestions liberates all the fixed ammonia, and the stills should be so operated that the waste liquors leaving the bottom contain not more than 0.005 per cent. of ammonia.

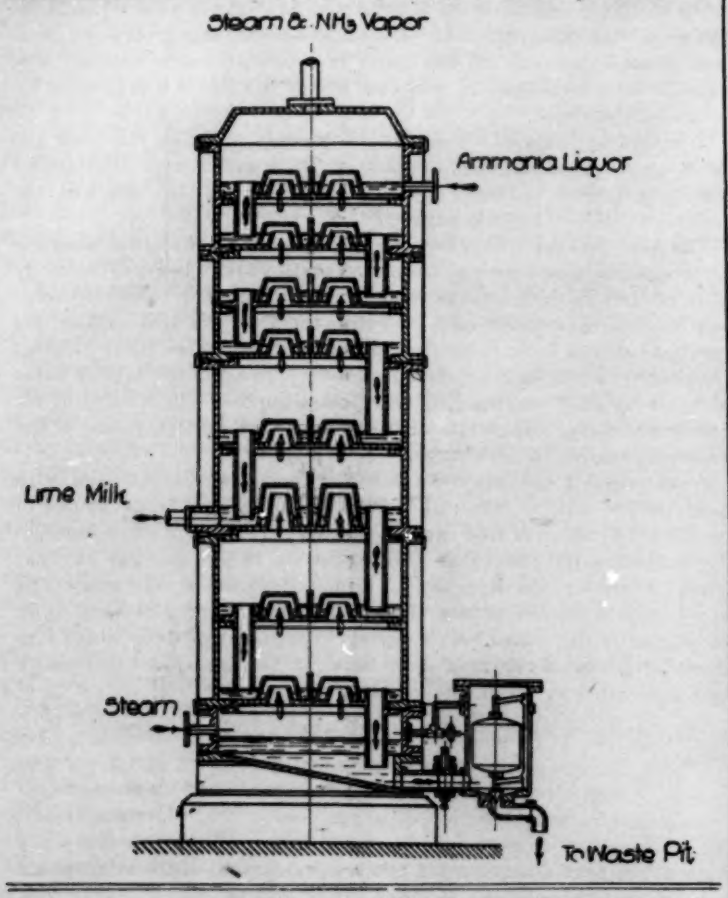


Fig. 3.—Ammonia Still.

If concentrated liquor is to be produced, the vapors coming from the still are washed in a lime washer to remove any carbonate of ammonia that may be formed, after which the vapors are condensed and run into storage.

The earning capacity of a concentrating plant operating in conjunction with a plant carbonizing 300 tons of coal per day should be, with ammonia at 8 cents per pound, about $25,788 per year, or—

375,000 lbs. of ammonia at 8 cents		$30,000
Labor	$1,830	
Materials	1,922	
Miscellaneous	460	
Total operating cost, less interest and depreciation		4,212
Profit per year		$25,788

If the weak liquor produced in the works can be sold as such, and if the ammonia in this liquor, based on the above prices of concentrate, is worth 6 cents a pound, the yearly gross revenue would be $22,500, but from this would have to be deducted the added freight due to shipping a larger bulk. In order to make the sale of weak liquor a profitable undertaking compared with concentrate, it would be necessary that an ammonia works be established in very close proximity to the gas works.

If aqua ammonia is to be produced, the vapors from the still are sent into lime washers, coolers, charcoal filters, oil washers, caustic soda washer, and finally into the absorbers.

The earning capacity of an aqua plant of the same size as that quoted above, should be about $47,030 per year, or

780 tons of 26° Bé. aqua at $102		$79,560
Labor	$3,630	
Materials	7,610	
Miscellaneous	21,290	
Total operating cost, less interest and depreciation		32,530
Profit per year		$47,030

If sulphate is to be made from the ammonia vapors, the vapors are sent into the saturators containing sulphuric acid, where the ammonia and the acid combine to form sulphate; and the earning capacity of such a plant, the same size as those above, should be about $30,809 per year, or—

727 tons of sulphate at $60		$43,630
Labor	$1,830	
Material	10,221	
Miscellaneous	760	
Total operating cost, less interest and depreciation		12,811
Profit per year		$30,809

During the last 15 years, the attention of investigators has been turned towards simplifying methods, and instead of treating the gas liquor as in the old or indirect system just described, the endeavor has been to pass the gas directly into and through the saturator, this method being termed the "direct process." Other investigators have proceeded along somewhat different lines, and while passing the gas through a closed saturator, vaporize the ammonia produced by previous condensation and then pass these vapors into the saturator in conjunction with the gas, this latter development being known as the "semi-direct" process.

The Feld system is more truly a "direct process" than any of the methods mentioned as sulphuric acid is not used; and when it is remembered that the production of one ton of sulphate requires approximately one ton of acid, the importance of this advanced step can be realized. Feld combines the sulphur in the gas with the ammonia thus producing ammonium sulphate by his polythionate process, no other oxydizing agent, except atmospheric oxygen, being required, and the latter is used only in the stove where the sulphur is burned to form sulphur dioxide, this sulphur stove displacing the sulphuric acid factory which has hitherto been necessary.

The method of operation can best be understood by following the diagram. The plant is started by filling the regenerator tanks *B* and *C*, and the wash liquor tank *D* with weak ammonia liquor from the works, or with fresh water; this liquor or water being then pumped into the supply tank *U*, from whence it flows into the top of the washer *A*. Ammonia extraction follows immediately, and the liquor flows from the bottom of the washer as thio-sulphate, entering regenerator *B*; where it is treated with sulphur dioxide coming from the sulphur stove *F*, the dioxide being forced through the liquor by pressure from the compressor *G*. The overflow from regenertor *B* enters regenerator *C*, where a further treatment with sulphur dioxide is effected, and then enters the wash liquor tank *D*, from whence it is again pumped to the washer. Alternately treating the liquor with sulphur dioxide and with crude gas forms polythionate in the first instance, and thio sulphate in the second, the polythionate being the active washing medium; an equivalent amount of hydrogen sulphide is removed from the gas in conjunction with the ammonia in the washer.

When the liquor has attained a strength equivalent to 35 or 40 per cent. of ammonium sulphate, a portion of this concentrated solution is pumped into the oxidation or finishing tank *H*, it being replaced in the circulating system with weak liquor from prior condensation. In *H* the polythionate liquor is treated with heat from a steam coil, and some sulphur dioxide, if this should be necessary; by this treatment the thio-sulphates are transformed into polythionates, which are in turn decomposed into sulphate and free sulphur. The decomposed liquor is drawn off from the finishing tank onto the sulphur drain board *J*, and the free sulphur, in the form of hard grains, is placed in the centrifugal *K*, where its moisture is expelled. This sulphur is returned to the sulphur stove for the further production of sulphur dioxide. The liquors from the drain board and that from the centrifugal flow to the precipitating tank *Q*, where it is treated with concentrated ammonia, or $(NH_4)_2S$ from the condenser *T*; this liquor is then transferred to the storage tank *L* and pumped from there to the vacuum boiler *M*. The concentrated ammonia from the still and condenser is sent into the precipitating tank in order that any iron in suspension may be thrown down, insuring a clean, white salt; the amount of ammonia used for this purpose is very small, but it is all recovered in the sulphate. The liquor is evaporated in a vacuum (an open evaporator may be used if desired) in the boiler, and the salts are drawn out onto the drain board *N*, and from thence to the centrifugal *O* and rotary dryer *P*, the salts thus produced being ready for bagging and shipping. The mother liquor from the drainboard and centrifugal returns to tank *L* and from there is pumped back to the boiler.

The still *R* is used for the purpose of evaporating any ammonia

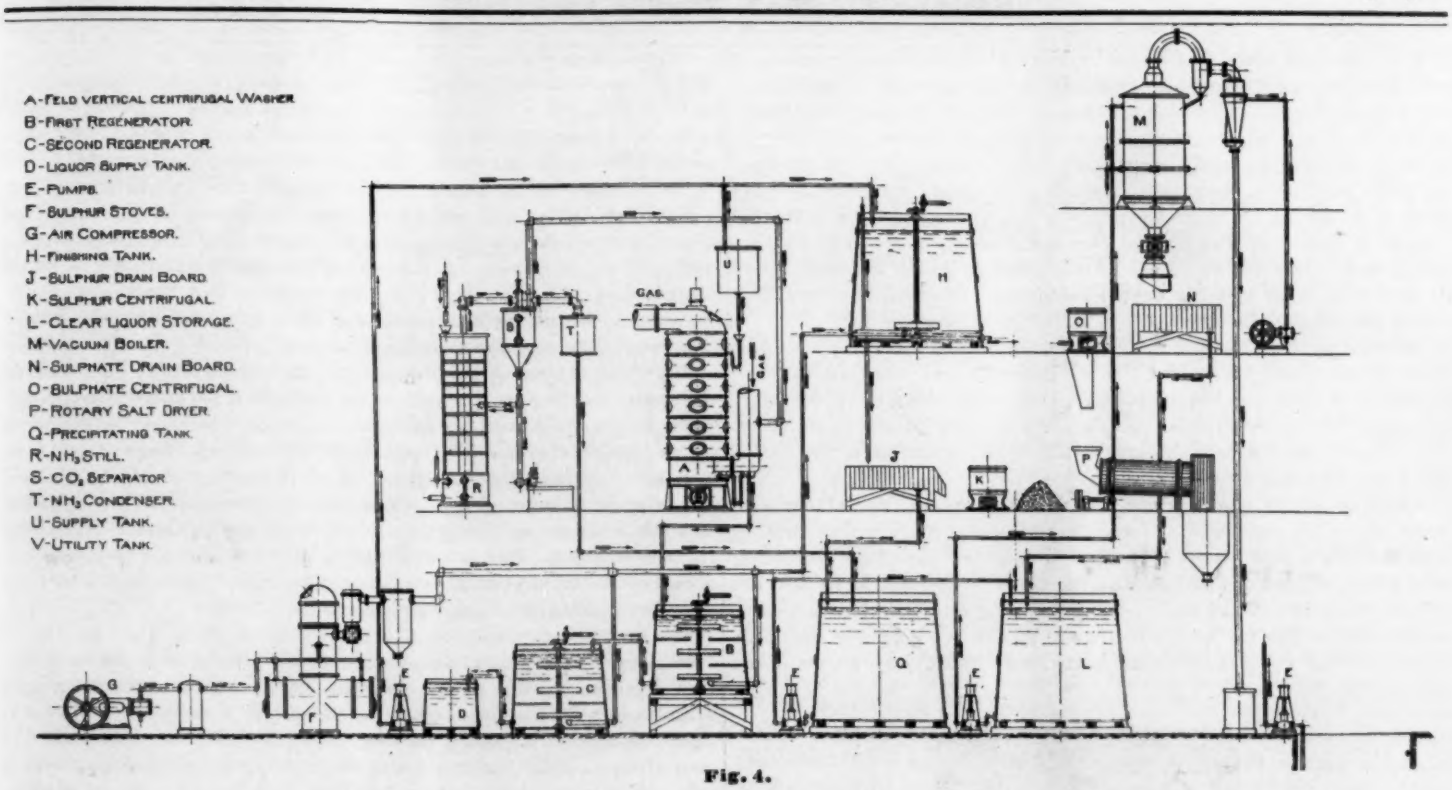


Fig. 4.

liquor thrown down by previous condensation, these vapors being returned to the gas at the inlet to the washer, a small portion of the vapor being sent into the condenser *T* for producing the $(NH_4)_2S$ used in the precipitating tank. If Feld's system of hot tar extraction is installed, a still will not be necessary, as there will be no precipitation of ammonia; neither is a still necessary if the production of ammonia liquor does not exceed the amount of liquor required in circulation.

This process requires but very little expert control, the mechanics attending the machinery being capable of making the necessary liquor tests after a little instruction.

The Bueb process for the extraction of cyanogen produces ammonium sulphate in solution, and therefore, in combination with the Feld explained above, forms a very remunerative proposition.

The income from such a combined plant in a works carbonizing 300 tons of coal per day is approximately as follows:

Cyanogen	128,500 lbs. at 13.25c	$17,025.00
Sulphate	1,349,250 lbs. at 3.00c	40,477.50
NH_2 in press cake	29,750 lbs. at 7.00c	2,082.50
Total gross earnings		$59,585.00

Operating expenses are:

Materials	$3,695.00
Steam	1,663.00
Power	2,688.00
Miscellaneous	1,000.00
Labor	2,500.00
Total operating expense	11,546.00
Net earnings per year less interest and depreciation	$48,039.00

Benzol.—While the removal of benzol from gas is not of remunerative interest to the coal gas producer under present standard of gas sale by candle power, it is of interest to the by-product coke oven operator, and as all of the preceding data applies to both of these producers, the method of improving and purifying benzol is herewith included.

Benzol is recovered from coal gas after the tar and ammonia have been removed, and all modern systems are based on the process carried out by Brunck in 1887. The gas is washed in a series of washers with light oil, the oil absorbing the benzol, after which it is subjected to distillations, producing benzol, toluol, xylol and solvent naphtha.

The Koppers Company states that the income from extraction of benzol from the gas produced by the carbonization of 2,000 net tons of dry coal per day, is as follows:

Yearly Recovery.

Benzol, 67 per cent	978,000 gallons.
Toluol, 16 per cent	234,000 gallons.
Xylol, 8 per cent	117,000 gallons.
Solvent naphtha, 9 per cent	131,000 gallons.
Total	1,460,000 gallons.

With a gross income of—

1,460,000 gallons at 15 cents	$219,000
Crude napthalene, 330 net tons at $5	1,650
Regenerated acid of 40° Bé., 360 tons at $6	2,160
Total gross income	$222,810

The operating expense per year being—

Raw material, consisting of wash oil, sulphuric acid, caustic soda	$15,000
Steam for distillation, air compressor, loading pumps, acid regeneration and cooling water,	15,000
Electric power for water pumps, oil pumps, agitator, illumination	6,200
Wages for 3 distillers and 2 helpers	5,000
Overhead expenses, fire insurance, maintenance and depreciation, assuming the cost of the complete plant to be about $300,000	30,000
Calorific loss of the gas	13,000
Total operating expense	$84,200

giving a net profit of $138,610 or 46 per cent. on the investment capital, and making the cost of producing 1 gallon

$$\frac{\$84,200}{1,460,000} = 5.8 \text{ cents.}$$

This profit is, of course, dependent upon the selling price of benzol and the cost of raw material.

Calorizing Metals; A Treatment Preventing Metals from Burning at High Temperatures.

[By H. B. C. Allison, in *General Electric Review.*]

Since the close of the bronze age iron has been used for ovens, utensils and tools for all temperatures up to dull red; but for higher temperatures there is even at the present date no cheap metal available. Copper, and most of the alloys, brasses and bronzes, will not withstand heating in the air to red heat. Nickel and cobalt are the most stable of the metals which may be worked or cast, are fairly cheap and will withstand moderately high temperatures. Some alloys containing nickel are also quite permanent in the air at red heat.

A process has been discovered by Van Aller for heating metals in revolving drums with mixtures containing, among other things, finely divided aluminum, by which a surface alloy is produced. With copper, this alloy is of the nature of an aluminum bronze, but richer in aluminum than the ordinary alloy of that name and more resistant to heat, so that copper thus treated is protected up to the melting period of the alloy from the scaling which occurs when untreated copper is heated above 300° C. The same result is obtained on iron and steel. Some use was made of this process, which has been called "calorizing," for treating copper soldering irons and iron resistance wires for heating devices.

Modifications of the process, extending it to further applications, have been made by E. G. Gilson. Pieces which, because of their shape and size, are not adapted for tumbling, may be calorized by packing them in, or paintingthem with, a suitable mixture, and heating. Thus, the size of the heater is the only limitation on the size of the piece that may be calorized.

There are many places where it is desirable to use iron at temperatures above red heat, and at such temperatures ordinary iron rapidly oxidizes and scales away. After iron is calorized the effect of heating is slight. Instead of burning and the scale falling off, as in the case of untreated iron, practically no effect can be detected after a considerable time. This is well illustrated by the two pieces of iron pipe shown in Fig. 1. The two were heated side by side, by an ordinary

Fig. 1.—Two Pieces of Iron Pipe from the Same Tube, the lower one Calorized, both Subjected to the Same Temperature for the Same Length of Time.

laboratory blast lamp to about 900° C. for a period of 4 hours, then cooled and the heat once more applied for another 4 hours. At the end of that time the untreated pipe was badly burned, the point where the flame was directly applied having been reduced to one-half the original thickness, while the whole surface was blistered. The contrast between this piece and that which was calorized is very marked, for even upon close examination the calorized pipe appears to be unchanged.

The piece of calorized pipe used in this experiment had previously been used in work, where it had been alternately heated to 1,000° C., and cooled in an electric resistance furnace open to the air. The total time during which the maximum temperature was maintained was about 50 hours. A rather extreme test was applied to this same piece by heating it to about 900° C. and plunging it into cold water, after it had cooled to a dull red. This was repeated three times and the surface showed no signs to crack or any tendency to scale.

Another application of this process is to iron wire or ribbon, such as is used in electric heating units. An untreated piece of this ribbon will burn out in 4 or 5 hours at the most, whereas tests upon calorized pieces have shown that the life is increased at least fifty fold, and in the best instances over one hundred fold. The results of tests made at Pittsfield indicate that a life of over 500 hours may be expected from calorized heating units run at a temperature of 800° C.

Calorized seamless iron tubing is being used for combustion tubes in research analytical laboratory, where pure oxygen is brought in contact with the metal at temperatures from 900° to 1,000° C. These have thus far operated all right and still appear unalered after nearly 100 hours' use.

The above facts seem to indicate that this is a simple method for extending the use of iron under oxidizing conditions at high temperatures, and for greatly prolonging the life in those instances where it is now used, but must be renewed at frequent intervals. In the case of small muffles on crucibles, where temperatures are below 1,000° C., this treatment of cheap cast or wrought iron shapes seems very promising. While the life of the coating depends on the temperature at which it is used, as well as on the time taken in its preparation, i. e., the quantity of aluminum which alloys with the surface of the iron, it does not permit of long use at temperatures much in excess of 1100°.

Copper parts that are exposed to high temperatures can have their life increased by calorizing. In some cases calorized copper may be used advantageously in place of aluminum bronze.

In some cases the life of copper contacts can be increased by calorizing. For instance, a set of railway controller contacts which were calorized showed double the life of the ordinary untreated contacts.

The dimensions and weight of either a copper or iron piece are slightly increased by calorizing. The increase of dimension is much less than the thickness of the alloy coat, the greater part of which simply takes the place of the original metal. The dimensions may, however, increase several mils and there is a tendency to a greater increase at the edges than on flat surfaces.

For iron, calorizing is intended only for protection at high temperatures. It does not compete with galvanizing, sherardizing, and other similar processes for protection against oxidation or corrosion at low temperatures. Its usefulness lies within a range of temperature much higher than a galvanized or sherardized coat could stand. For copper, calorizing is effective against corrosion at low temperature as well as against oxidation at high temperature. The upper limit is determined by the melting point of the alloy, which is somewhat lower the heavier the calorizing treatment, since that means an alloy with a higher aluminum content.

The probable explanation of the effect of the aluminum in the surface alloy is that a thin coat of alumina forms which prevents further burning of the metal beneath. It is well known that a pure aluminum wire may be heated in the air to a temperature several hundred degrees above its melting point, without flowing, when the thin alumina shell which surrounds and supports the molten metal is easily seen.

Water Heating by Gas.[1]

[Prepared by H. R. Basford, for the Twenty-second Annual Convention, Pacific Coast Gas Association.]

Gas water heating is a very important utilization of gas. The world owes a great debt to the men who have brought the gas water heater to the present state of perfection, because sanitation, prevention of disease, better bodily health through frequent bathing, have all been largely brought about by its advent. The gas water heater has made it possible for the humblest cottager to procure hot water cheaply and quickly for his every need. As a means of increasing the use of gas the tank water heater has, in numberless cases, been the company's wedge into the home. Many people who refused to entertain the idea of gas cooking have been brought to use it through inducing them first to install the labor-saving, economy-producing water heater—so that both to the consumer and the gas company the water heater has been a blessing.

In preparing this paper, it has been my aim to deal with the subject in such a manner as to make it of everyday value to those in the commercial department, so that they may guide the inquiring prospect to the correct installation, and, still more important, to enable them, if possible, to show a person who has never used a gas water heater, the saving and comfort of such a device.

Probably the best technical paper on the gas water heater is in the educational course of the N. C. G. A. Read this paper carefully and preserve it for reference. I shall give only such technical detail and tables as make this paper a practical manual for the salesmen.

Heat Measure.—The accepted standard of heat is the British Thermal Unit (B.T.U.), being the heat necessary to raise the temperature of 1 pound of water 1° F. There are 8⅓ pounds in each gallon of water at 62° temperature. Therefore, if we want to know the heat units required to heat water to any temperature, the formula is as follows:

Number of gallons × 8⅓ × the number of degrees between the actual and the desired temperature, equals total B.T.U.'s required.

If we could secure an appliance which would make it possible to transmit all the heat units of the gas to the water, it would only be necessary to divide the above by the B.T.U.'s in a cubic foot of the gas to know the number of feet of gas required. But as it is impossible to construct such a device commercially, we are brought to the question of efficiency.

Efficiency.—Efficiency is the percentage of the B.T.U.'s in the gas which is absorbed by the water. For example: 10 feet of gas of 600 B.T.U.'s per cubic foot; 9 gallons of water (75 lbs); temperature before heating, 60°.

1. Slightly abridged.—Eds.

Temperature after heating 140° (80° raise) would show 100 per cent. efficiency.

If, in the above example, the appliance burned 15 feet to produce the result, we have used 9,000 B. T. U.'s, whereas theoretically only 6,000 are needed. Therefore the efficiency is as 6,000/9,000 or 66⅔ per cent.

To determine the efficiency of a circulating tank heater or a combination boiler, practical results can be had by equipping a 30-gallon boiler with four thermometers; one 2 inches from top and then 18 inches apart. Take record of temperatures and gas meter reading. Then light the appliance, taking complete readings every 5 minutes until the bottom of boiler is fairly hot. or until the average of all the thermometers equals a pre-determined temperature, which for household use should be 140°.

Take the feet of gas consumed, multiply by the B. T. U. shown by the plant analysis; this will give the heat used. Take the average degree raise of the water and multiply by the total weight of the water heated. Dividing these results gives the apparent efficiency.

Example.—30 gallons × 8⅓ = 250 pounds × 80° average raise = 20,000 B. T. U.'s needed. If 50 feet of gas were used at 600 B. T. U.'s = 30,000 B. T. U.'s used. Efficiency is as 20,000 to 30,000 or 66⅔ per cent.

The apparent efficiency can be obtained at any given point of time or for any amount of water in boiler by referring to the interval readings, down to any thermometer—for example, a 30-gallon boiler is 5 feet long and contains 1 gallon or 8⅓ pounds of water for every 2 inches of length. Suppose the second thermometer after 15 minutes burning, showed 80°, and the top thermometer, 160°. The average would be 80° + 160° ÷ 2 = 120° or 60° average raise for 20 inches or 10 gallons, or 83.33 pounds of water. Supposing the gas consumed was 15 feet at 600 B. T. U.'s per cubic foot.

60 × 83.33 = 4999.8 B. T. U.'s needed.
15 × 600 = 9,000 B. T. U.'s used.
Apparent efficiency is as 4999.8 to 9,000 or about 55.5 per cent.

It is much harder to get the efficiency of an Instantaneous Automatic Heater, as it is necessary to weigh and take the temperature of ingoing and outgoing water at 1 minute intervals. This requires elaborate preparation and cannot be successfully accomplished outside a laboratory. Instantaneous Heaters of the standard types do not vary over 10 per cent. in efficiency and in actual practice show between 70 and 80 per cent.

Combustion.—With the proper admixture of gas and air in a burner all the carbon will be consumed to carbon dioxide, and hydrogen to water vapor.

1. Care must be taken in constructing the mixing tube to give free entrance to the air, sucked in by the velocity of the gas blowing through the gas orifice, thus supplying sufficient primary air.
2. An easily operated air adjusting shutter must be supplied at the opening in the neck.
3. The burner must be constructed with regard to the volume of gas and air which is liberated through it, and so that secondary air will reach and surround each jet of flame in the burner head.
4. Proper vent for the products of combustion must be provided, both through the coils and by vent holes at the top of the heater so that there will be no shifting of the flame.
5. What is known as the "cone" of the flame that shows a greenish blue cone-shaped flame within the flame proper, must never be allowed to impinge against a metal surface, or combustion will be retarded.

Primary air is the air which is drawn into the mixing tube. Sec-air is the air drawn into the flame, and furnishes additional oxygen to complete combustion.

It is essential that the products of combustion be taken away quickly. This makes a flue connection imperative, and some heat must be lost to facilitate the elimination of the burned gases. This certain loss of heat units or efficiency, if not excessive, is beneficial, as it helps to perfect combustion, but draught in a flue may be so strong as to draw the heat away from the heater, too quickly, thereby wasting gas. Therefore a flue should be tested with a burning paper and if the draught is too strong slightly choke the flue connection. Flue connections to water heaters should be insisted upon by gas companies, even to the point of refusal to set a meter unless they are made, because of the danger of escaping gas, the poisonous effects of the products liberated in a room, and the deposit of water vapors on the walls, which cause great prejudice against the use of gas.

Types of Heaters.—Those in vogue to-day are divided into four general groups:

1. The Circulating Tank Heater.
2. The Combination Boiler.
3. The Large Automatic Storage Heater.
4. Instantaneous Automatic Heater.

Tank Heaters are those usually installed in modest dwellings, connected on the side of boilors. The shells are usually of cast iron, the heating units usually copper coils from 16 to 25 feet in length. There are, however, a few with single coil units of 12 to 16 feet. A few manufacturers still make the cast iron heating unit. These do not show the efficiency of the copper coil as a rule, although some of them are superior to the cheaper coil units, and one, at least, has maintained a steady sale for a long period of years. The double copper coil heater, having 25 feet of ¾ coil, has proven to possess the greatest value. Several sizes are made, and where a tank of from 50 to 80 gallons is to be heated, it is advisable to use a large heater.

The practice of connecting heaters or combination boilers in closets should be discouraged. Many times such a heater is lighted and forgotten for hours. This wastes gas, forms steam in the boiler, and if it does not actually set fire to the house, gives the neighbors hot water in the cold water pipes. Users should be urged to install a sediment cock at base of water line leading to the heater, and to draw off the sediment at least once a week, or even every day if the water contains much sediment. If the gas company installs the heater, they should put on the cock. A tank heater should always be located so that the bottom of the coil is below the bottom of the tank. Many excuses are made, among which is that the customer will not stoop so low to light the heater. The salesman should convince his buyer that it is money saved to place the heater low on account of the better circulation obtained. The customer will generally want to save the money. As few ells and tees as possible should be used in the connections. The question is often asked, "Is it best to connect the flow line from the heater to the side or top of the boiler?" If the heater is to be used in restaurants or lodging houses, where a volume of water is needed, the side connection is best. If, in an average residence where, the majority of times, only part of the boiler is heated, the top connection is best.

Very often the salesman finds a water-back in the furnace. It is well to praise that and show the advantage of the water heater for days when the furnace is not in operation. The salesman should endeavor to persuade customers to remove circulating tank heaters of obsolete design. The length of time necessary to heat water with such a heater discourages the use of gas for water heating. Each of such removed should be tested to furnish salesmen with comparisons, to insure the replacement of all unsatisfactory types. Referring a prospective customer to a neighbor who has a modern heater many times clinches a sale.

Combination Boilers are generally similar as to heating units and internal gas flame. The units vary from brass star shaped disks to cast iron inverted cones and copper coils. Where space is limited they may be used with advantage. They are sometimes used with thermostats making their action automatic.

Automatic Storage Systems of the large type all have copper heating coils. They are intended for large buildings, very large residences where there is a circulating system of hot water pipes, and where the peak load call for water is greater than an instantaneous heater can supply. In some cities nearly all the really large residences still burn coal for cooking; and here a storage system should be installed. The coal fire goes nearly all day, and with the device known as the "moment valve," the storage heater works automatically whenever the boiler drops below a predetermined temperature. As these valves work on a differential in temperature of about 25°, great economy is effected. For instance, if the valve is set to turn on at 120°, it will turn off at 145° and not relight until it again drops to 120°. This enables the range to recover the temperature from any slight draught of water without lighting the gas. A graduating thermostat should never be used with a storage system. For lodging houses, apartment houses or hotels, no better system has been devised, but the price of gas in most cases, makes it prohibitive for buildings of over fifty rooms. There is a very wide field for these heaters when the rate-making power is removed from politics, and gas companies can make a low rate for this type of business.

The Instantaneous Automatic Heater was pronounced a few years ago by the Franklin Institute the greatest domestic invention of the

(*Continued on page* 314.)

THE AMERICAN GAS LIGHT JOURNAL INC.

Entered at the Post Office, New York City, as Second-Class Matter.

Published weekly at 42 Pine Street, New York City.

Telephone Call, John, 2996. Cable, Am-Gas.

E. P. CALLENDER, President.
A. M. CALLENDER, Vice-President and Treasurer.
CHARLES H. WADELTON, Secretary and Manager.

SANFORD K. CAMPBELL, Editor.

Agents—American News Co., 11 Park Place, New York City.
Lemcke & Buechner, Berlin, Germany.
Aug. Siegle, 30 Lime Street, London, England.

TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico, $3 per year. Canada, $4 per year. All other countries, $5 per year.
Single Copies, 10 Cents.

NOTICE TO ADVERTISERS.

New Advertisements and changes of copy therefor should be in hand Wednesday noon of week prior to date of issue.

NEW YORK, MONDAY, NOVEMBER 16, 1914.

[Official Notice.]

Transportation Arrangements, National Commercial Gas Association Convention.

Following the custom of recent years, and in order that the majority of those who attend the Tenth Annual Convention of the N. C. G. A., at Minneapolis, November 30 to December 5, may do so with a minimum of fatigue and inconvenience and a maximum of comfort and pleasure, the Transportation Committee has arraigned for special train service.

The special train will leave the Pennsylvania Terminal, New York, via the Pennsylvania Railroad at 4:30 P.M., Saturday, November 28, will stop at Newark, Philadelphia, Harrisburg and Pittsburgh, to pick up members of the Association, and arrive at Union Passenger Station, Chicago, at 5:30 P.M., Sunday, November 29. Leaving Chicago at 11:15 P.M., via the Burlington Route, the train will follow the Mississippi River for 300 miles, and give the delegates the delightful experience of viewing the historic and romantic scenery of the upper Mississippi River by daylight the following morning; and reach Minneapolis in ample time for registration before lunch.

Schedule.

Leave Boston	10:00 A.M.,	Sat.,	Nov. 28.
Arrive New York	3:36 P.M.,	"	" "
Via Pennsylvania Lines—			
Leave New York	4:30 P.M.,	"	" "
Leave Newark	4:52 P.M.,	"	" "
Leave No. Philadelphia	6:34 P.M.,	"	" "
Arrive Broad Street Station, Philadelphia	6:48 P.M.,	"	" "
Leave Broad Street Station, Philadelphia	7:03 P.M.,	"	" "
Leave W. Philadelphia	7:07 P.M.,	"	" "
Arrive Harrisburg	10:00 P.M.,	"	" "
Leave Washington	6:15 P.M.,	"	" "
Leave Baltimore	7:25 P.M.,	"	" "
Arrive Harrisburg	9:50 P.M.,	"	" "
Leave Harrisburg	10:15 P.M.,	"	" "
Leave Altoona	1:55 A.M.,	Sun.,	Nov. 29.
Leave Pittsburgh (Central time)	4:15 A.M.,	"	" "
Arrive Chicago	5:30 P.M.,	"	" "
Via Burlington—			
Leave Chicago	11:15 P.M.,	"	" "
Arrive Minneapolis	11:30 A.M.,	Mon,	" 30.

The N. C. G. A. Special will carry the finest of modern equipment, including standard drawing-room and compartment sleeping cars, club car and library-observation car. The train will be operated by picked crews of Pennsylvania and Burlington men. Everything possible will be done to make the entire journey a genuine pleasure from start to finish.

Berth reservations should be made through the nearest member of the Transportation Committee. In order that the necessary number of sleeping cars may be provided to insure comfortable accommodations, it is essential that the railroad companies know as soon as possible how many will use this train. Delegates from Washington and Baltimore, taking this train at Harrisburg, should send requests for reservations to Philadelphia.

Transportation Committee.

L. F. Blyler, Minneapolis Gas Co., Minneapolis.
A. P. Brill, Ruud Mfg. Co., Pittsburgh.
C. W. Hare, U. G. I., Co., Philadelphia.
O. T. Knight, People's Gas Light and Coke Co., Chicago.
H. B. McLean, Consolidated Gas Co., New York City.
R. C. Ware, Boston Consolidated Gas Co., Boston.
H. H. Wells, Public Service Gas Co., Newark.
B. J. Kellum, Chairman, Welsbach Co., Chicago.

BRIEFLY TOLD.

Program of the National Commercial Gas Association Convention: Minneapolis, Minn., December 1, 2, 3, and 4.

Tuesday, December 1st.

Morning Session, 10 to 12:30.

Address of Welcome by Hon. Wallace G. Nye, Mayor of Minneapolis. Responded to by Mr. E. N. Wrightington, Vice-President Boston Consolidated Gas Company.
Address by Mr. James J. Hill. Responded to by Mr. Thomas N. McCarter, President Public Service Corporation of New Jersey.
Roll Call and Reading of Minutes.
Report of Board of Directors.
Report of Treasurer.
Report of Finance Committee.
Report of Committee on Amendments to Constitution.
Report of Committee on Public Policy.
Report of Committee on Membership.
Report of Committee on Local Sections.
Address of President.
Report of Nominating Committee.
Report of Time and Place Committee.

Afternoon Session, 2 to 5.

Report of Committee on Relations with Customers, by R. R. Young.
Report of Committee on Standardization of Gas Appliance Specifications, by O. H. Fogg.
Report of Committee on Salesman's Handbook, by H. D. Gillingham.
Report of Board of Educational Control, by Robert Ffrench Pierce.
Report of Committee on Window Display (illustrated), by J. P. Zingg.
Report of Committee on Booklets, by J. A. Norcross.

Wednesday, December 2d.

Morning.

There will be no regular general session in the morning. The Exhibition Hall will be open to members, however, and all the delegates are requested to inspect the exhibits.

The Industrial Fuel Committee will hold a special session from 10 to 12:30 in the Convention Hall at the Armory. (See program below.)

A special meeting of the Publicity Committee will also be held between 10 a. m. and 12:30 p. m. in the Ball Room of the Radisson Hotel. Members interested in advertising or the publicity end of the business should attend.

The Educational Committee will also hold a special session in the Empire Room of the Radisson Hotel from 10 a. m. to 12:30 p. m. Dr. Galloway will preside.

Afternoon Session, 2 to 5.

Paper, "How to Select, Train and Hold Your Selling Force," by C. H. French.
Report of Committee on Publicity, by R. C. Fowler.
Report of Monthly Bulletin Committee, by J. L. Conover.
Address, "Direct Advertising as Applied to the Gas Business" (illustrated), by Alan R. Fernald.
Report of Committee on National Advertising, by C. W. Hare.

Thursday, December 3d.

Morning Session, 10 to 12:30.

Paper, "Securing and Retaining Residence Lighting," by W. A. Morris.
Report of Committee on Indoor Lighting, by Sidney Mason.
Paper, "House Maintenance Service," by Arthur Hewitt.
Report of Committee on Heating, Ventilation, and Refrigeration by George S. Barrows.

Afternoon Session, 2 to 5.

Paper, "How to Secure All-Gas Kitchens in Old Houses," by H. K. Dodson.
Report of Committee on Domestic Fuel Appliances, by J. J. Burns.
Report of Committee on Outdoor Lighting, by A. P. Ewing.
Paper, "Accounting," by A. P. Post.
Report of Committee on Accounting, by J. D. Shattuck.

Friday, December 4th.

Morning Session, 10 to 12 : 30.

Report of the Committee on Development of Industrial Fuel, by H. O. Loebell.
Report of Committee on Differential Rates, by F. W. Frueauff.
Report of Committee on Central Development, by R. C. Ware.
Report of Committee on Motion Pictures, by W. J. Clark.
Report of Manufacturers' Committee, by C. V. Roberts.
Report of International Committee on Commercial Advancement, by Arthur Hewitt.

Afternoon Session, 2 to 5.

Discussion on preceeding papers; and presentation of papers not read at the regular time assigned.

INDUSTRIAL FUEL SESSIONS.

Wednesday, December 2d.

At Convention Hall, the Armory, 10 to 12 : 30.

Possibilities of the Development of Industrial Fuel from the Commercial View Point, by J. M. McMillin.
Gas Fired Steam Boilers, by C. E. Chapple.
High Temperatures and Artificial Gas, by E. R. Rosen-Baum.
Flame Temperatures, by C. L. Henderson.
China and Glass Kilns, by T. D. Keyes.

In Ball Room, Radisson Hotel, 2 to 4 : 30 P.M.

Railroad Shop Equipment, by W. F. Clausen.
Carbonia Treatment, by B. B. Yeomens.
Brass Melting, by E. F. Davis.
Brass Melting, by O. H. Gindele.
Brass Melting, by P. F. Reichhelm.
Forging, by W. G. Phelps.
Converting Core Ovens to Gas, by E. J. Burke.
Brazing, by C. E. Chapple.
Pyrometers, by R. T. Brown.

Thursday, December 3d.

In Ball Room, Radisson Hotel, 10 A.M. to 12 : 30 P.M. and 2 to 4 : 30 P.M.

Results of a Campaign on Industrial Fuel, by L. Gaston.
Hotel Business, by Mr. Hawkins.
Hotel and Restaurant Burners, by Ivan A. Hay.
Hotel and Restaurant Ranges, by E. K. Slater and H. D. Gillingham.
Syphon Blast Hotel Ranges, by Samuel C. Bratton.
Recovering Heat from Flue Gases in Hotel Ranges, by J. L. Meyfarth.
Surface Combustion Broilers, by Russell E. Sard.
Butcher and Packing House Equipment, by W. T. Hudson.
Coffee Roasting, by A. H. Gindele.
Changing Dutch Ovens from Wood or Coal to Gas, by J. B. Redd.
Laundry Irons, by H. C. Russ.

ENTERTAINMENT FEATURES.

Monday: The Ladies' Committee will meet the visiting ladies at the Hotel Radisson, at 4 o'clock, where tea will be served; 8 : 30 P.M. President's Reception to meet visiting delegates, at Ball Room of Armory, followed by dancing and Inspection of appliance exhibits.

Tuesday, 10 A.M.: The ladies will attend the opening session of the Convention; 1 : 30 P.M., luncheon for the ladies at Donaldson's Tea Rooms, and trip to Minnehaha Falls.

Wednesday, 2 P.M.: The ladies will meet at the Hotel Radisson, and go to the Minikahda Club, where tea will be served; 8 : 15 P.M., the members and ladies will attend Theatre Party at Orpheum Thetre, after which supper will be served at Hotel Radisson—dancing—Bridge.

Thursday, 10 A.M.: Trolley trip for ladies to St. Paul, leaving Hotel Radisson, stopping at Minnesota State Capitol, where they will be met by the St. Paul Ladies' Entertainment Committee.

Friday: Trips to Flour Mills, Walker's Art Gallery, Art Museum, automobile tours, etc.; 8 : 15 P.M.; ladies will attend concert by Minneapolis Syphony Orchestra, Auditorium; or Party at Metropolitan Theatre. 8 : 15 P.M.: Members will attend an "Athletic Evening."

Saturday: Automobile tours and shopping for ladies.

AMERICAN ELECTROCHEMICAL SOCIETY DISCUSSES LIGHTING PROCESSES.—The New York Section of the American Electrochemical Society held its regular monthly meeting in Rumford Hall, 52 East 41st street, New York city, on Tuesday Nov. 10th. A Table d'Hote dinner served by the Steward of the Chemist Club, preceded the meeting. Mr. Colin S. Fink, Chairman of the Section, presided. The papers of the evening were classed as "Contributions of Chemistry to Illuminating Engineering." Dr. H. S. Miner, Chemist of the Welsbach Company, Gloucester, N. J., read the first paper, "The Improved Incandescent Gas Mantle." Dr. Miner gave the history of the development of the gas mantle from its inception by Dr. Auer von Welsbach, the various experiments with the rare earths and the progress in the development of the cotton, ramie and artificial silk mantle respectively, adding strength and efficiency through the various steps of progress.

This was followed by a paper by Mr. William A. Moore, of the National Carbon Co., on "Chemistry in the Development and Operating of Flaming Arc Lamps." Mr. Moore described the manufacture and composition of the carbons for electric arc lamps, bringing out the facts of the difference in the solid and cored carbons, the materials used in making them and the materials used in the cores; also demonstrating by projection upon the screen the resultant flame in the arc from each of the particular carbons used.

Mr. R. D. Mailey, of the Cooper Hewitt Electric Company, presented a paper on the "Quartz Mercury Lamp." Mr. Mailey brought out some interesting points on sterilization effected by the rays of the this lamp and several experiments were shown to demonstrate what reactions were effected upon certain chemicals by the rays from the lamp. The last paper presented, and one of great interest, was by Mr. D. Mac Farland Moore, of the Edison Lamp Works, on "The New Moore Tubes." Mr. Moore gave briefly the history of the development of this light in which gases and electricity together play parts in giving illumination, and how, after many attempts, the Moore tube was developed and perfected to its present state. He stated that the development of the Moore tube was an electrochemical proposition and hoped that some chemist would discover a gas that would make it possible to make the light more efficient.

The meeting was well attended and the papers given close attention.

PHILADELPHIA "GAS METERS."—The October meeting of the Philadelphia Section, Gas Meeters, held at Mosebach's Casino, on the evening of the 27th, was one of the best in the history of the Section. Dr. Thos. E. Eldridge, Philadelphia's prominent balloonist, delivered an interesting lecture on the "Science and Sport of Ballooning," illustrated by lantern slides. It has been remarked that Dr. Eldridge is an unusual customer of the U. G. I. Co., and is one of the few who call for their gas, put it in a bag, and take it away with them. The doctor praised the service of the gas company and its co-operation with him.

Commissioner Charles H. Ehrenseller arranged the details of the dinner and entertainment, and doubtless felt repaid for his efforts by the expressions of pleasure and appreciation heard on all sides. The results were splendid. Col. Roper made some interesting remarks, designed to banish any pessimistic thought in connection with business, and predicted the early appearace of general prosperity.

N. Y. SECTION, ILLUMINATING ENGINERING SOCIETY.—At the meeting Nov. 12th of the New York Section, I. E. S., the principal paper was on the new types of gas filled Tungsten lamps, presented by Dr. Clayton H. Sharp, of the Electrical Testing Laboratories, and this effort was of the same high order as his paper of about 8 years ago, on the early Tungsten lamps. Dr. Sharp stated that the obstacles in the way of measuring the new lamps with the 1½-watt standard, owing to difference in color values, had been overcome by means of filter screens; and that steps were under way to supply, through the Bureau of Standards, standard screens so that tests throughout the country would be comparable. The troubles from flicker had not been overcome, and the efforts to obtain uniform divergence brought to light some curious facts. With the tip upward, the difference in the horizontal candle power, due to flicker showed an extreme variation, from 60 to 240 revolutions, of 15 per cent.; whereas with the tip downward it was only 6 per cent. The operating characteristics change during the life of the lamp, a test on a multiple lamp showing a loss after 800 hours burning of 10 per cent. in horizontal candle power, and 20 per cent. in mean spherical power, this latter due to blackening. Also the filaments sag under operation, owing to high temperature. Dr. Sharp's summary of the results strongly advised rating these lamps in lumens per watt, and that they be measured in an integrating sphere.

Chairman Norman Macbeth found many to speak, and the discussion by Messrs. Rose, Rowlinson, Taylor, Amrine, Keene, Halvorsen and Millar brought out the fact that the bulb reflections and the convection currents in the lamps were further causes of discrepancies.

The second paper of the evening, also by Dr. Sharp, was a demonstration of types of commercial daylight lighting equipments, and again he won praise for original thought. As a preface to the demonstration the effect of colored lights on goods was shown by throwing a spectrum on different colored worsteds. The colors in the light were reflected where they touched similar colors on the fabrics, except in the purple, which reflected red and blue. Red and blue light have to be mixed before thrown on purple in order to reflect purple.

The audience were surprised to find such a large variety of color matching lamps available, eight styles being shown, using four kinds of illuminants. There was the Ives gas-daylight outfit, the Moore carbon-dioxide tube, the Intensified arc with blue and red filters, and two kinds of a glass developed in the laboratories of the United Gas Improvement Co., one shown with a Welsbach lamp, and the other with a Tungsten gas filled lamp. Two other equipments were shown which only approximate daylight, type C lamps equipped with two kinds of blue tinted opal globes.

The presentation was of an informal character, and so complete that the discussion did not bring out much of value, rather emphasizing the importance of extending the use of the lamps. Mr. Macbeth called attention to the fact that when these lamps are used in stores, regular lamps also should be installed as otherwise people would buy goods that matched under daylight but not under artificial light. On the question of absorption of the various equipments, Dr. Sharp said, all of them showed an absorption of over 90 per cent. Mr. Bond said that the educational value of the lamps shown was so great that he hoped it would be possible to exhibit them throughout the country. About 25 members and guests attended the informal dinner at Keen's Chop House, before the meeting.

(*Continued from page* 311.)

age. A standard type heater will raise with gas testing 650 B.T.U.'s, one gallon of water 65° for every foot of gas consumed. This is the cheapest known means of heating water by gas, and for residence use, is cheaper than any other fuel. Automatic heaters are sometimes called extravagant users of gas, but the use of a recording complaint meter and a water meter will show the user is extravagant, not the heater. Due to its construction it is ever ready to perform its task, and because it does not ask the user to pay for the gas before it furnishes hot water, the user may run up a large bill before the end of the month.

Instantaneous automatic heaters are divided into two classes—the thermostatic double fuel control and the non-thermomstatic or single valve type. Only the very small heaters are of the single valve type, although one manufacturer puts the thermostat on the water valve, with practically the same result when any real call for thermostatic safety action arises. It is best to discourage the sale of non-thermostatic heaters because of the lack of safety thermostatic action. They are made only because of the possibility of selling a price lower than a thermostatic heater, and as the gas company is the one who suffers in the long run, it is to its interest to avoid anything which may produce trouble. There are several small thermostatic heaters which sell at but a small advance over the straight valve type. The larger types are made in several sizes; the largest handling from 12 to 16 apartments or 60-room lodging houses, where only a few baths are installed. Recently circulating boosters have been devised, which enable the use of this heater where there are circulating hot water systems.

Thermal valve heaters require water pressure to make them operate. See that there is at least 8 pounds pressure at the highest faucet. Fifteen pounds pressure at the highest point is better, and where it is lower a larger sized water valve than the standard should be used. Special automatic heaters are made to work at quite low pressure, but they should never be offered before giving exact conditions to the makers. Anyone who can afford to build a home costing $3,000 and over, can afford to purchase and use an automatic heater.

Extravagant claims are made by some water heater manufacturers and it is astonishing that gas companies sell appliances without testing them, when such simple means as suggested in this paper are available. How few of you have ever taken the trouble to test a water heater. For your consumer's interest, and that also means your own, you should accept no heater for sale without proving its worth. It is often stated, "I have never heard a complaint of such and such a heater, and it is much cheaper than yours." Any tank heater will heat water much more quickly than a range water-back, and to a person who has never owned a really good heater most any seems a blessing. The public looks to the gas company for guidance in the purchase of an appliance. If the appliance is really good, it aids the company in further sales; if inefficient, it means the greater effort later in placing gas appliances.

Gas companies should discourage the manufacture of cheap inefficient appliances of every sort. First, because the companies suffer in the long run and it discourages those who are endeavoring to make the best appliance possible. Unless they can get the support of the gas men generally for high grade merchandise, they are forced to manufacture cheaper goods to meet competition or to go out of business. If gas men will offer only such gas burning devices which by careful test for efficiency and examination for character of material and workmanship, are shown to be worthy, the result will be more gas consumed, and less time spent convincing a prospect that gas can be used successfully, and more time spent for more prospects through being able to close sales more quickly.

The two illustrations show the proper method of connecting automatic water heaters. First, the straight connection, by which is meant connecting the heater directly to the water supply from the street; and second, the re-heating connection, necessary where the water to the heater runs through the kitchen boiler.

Automatic Water Heater Troubles. — If unable to correct any heater trouble, write to the agent, giving full information, including the water pressure at the highest faucet and the size and serial number of the heater. He will then be able to advise you. Do not disturb the thermostat adjustment; it is all right. If the pilot light goes out, insert a draught hood in the flue pipe and place the same as far above the heater as possible. Clear out the pilot valve "B" by turning it full open for a minute. If this does not overcome the trouble, turn the gas off at the meter, then turn out the handle of the pilot valve "B" until it comes entirely out. Clear out anything that

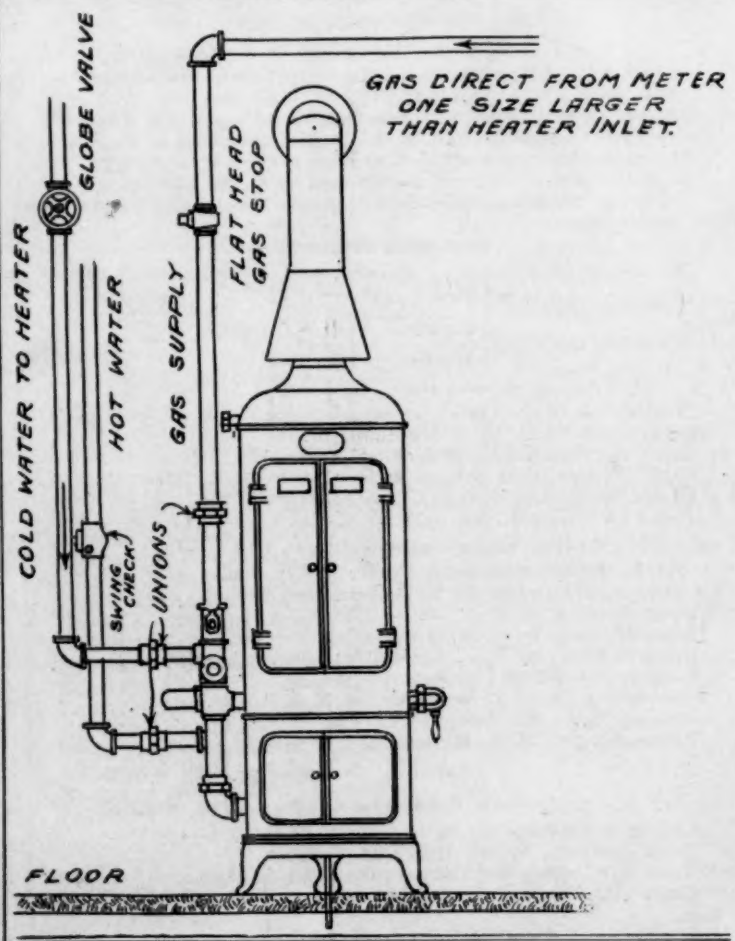


Fig. 1.

may be clogging the valve. See that the pilot light is not turned too low.

In severe cases of down draft, it will be necessary to advise that the flue either be extended or a proper chimney top installed. Flue connections should always be extended above the highest part of the roof. Never run a heater vent outside of the building without extending it to the roof.

If the plunger in the water valve sticks and holds the primary gas valve open, see that there is no undue strain on the water cylinder, caused by the piping being out of plumb, thus causing the cylinder to bind. Then take the plunger out and remove the hard spots with a smooth file or emory cloth; or, if the trouble is from sediment, clean the valve with gasoline. Several trials may be necessary, and care should be taken that no more be taken off than may be necessary. Valve plungers need no oil. They are constantly lubricated by the water which passes over them.

See that the ports are not clogged with mud; also the plunger hole in the cylinder end. Never use a hammer to remove a plunger. If stuck very tight, apply sufficient heat to expand the valve body, when the plunger can be easily removed. Never file a plunger so that it will leak; in this event the heater will not operate, and a new valve will be required. Should the heater not heat the water to the required temperature, it is because the gas supply is not adequate or that too much water is allowed to run through the heater. Adjust the latter by the water controller, usually marked "C", measuring the flow per minute at the nearest faucet when opened full. The proper supply or pressure of gas can be ascertained with a pressure gauge attached by hose to one of the gas spuds. When the heater is in operation the pressure should not be less than 2 inches of water.

In replacing an old-style pilot burner, care must be taken to use a long nipple, or the light will be too low for the main burners. Be careful about this in order to prevent explosions. If any of the burners burn a white flame, take it off and clean, or renew gauzes. An easy way to clean gauzes is to heat them over a gas flame until red-hot and then dip them into a solution of vinegar and salt. If the coil is covered with carbon, the efficiency of the heater is very much reduced. Clean off with a stiff brush. See that the pilot light is at proper height and close to one or more of the main burners; see that the pilot light gas orifice is a little above the orifice in the burners.

To prevent explosions, make sure that the primary gas valve is

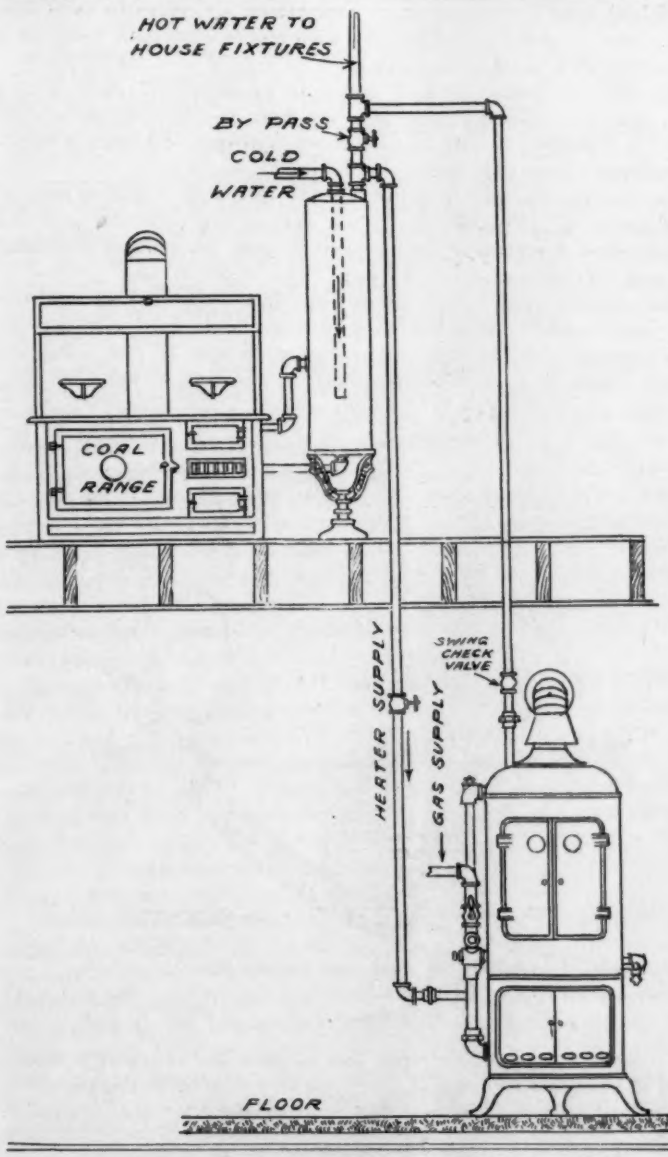


Fig. 2.

tight. This can be determined by removing one of the main burners and applying a lighted match to the spud. If there is a small amount of gas escaping to the burners, and if it continues to burn, the cap of the upper gas valve should be removed and the water valve center taken out. Clear out any dirt that may be in it; see that no particles of brass are imbedded in the leather seat, also that this has no imperfections, and that it is of uniform thickness. If it cannot be made to seat perfectly, substitute a new leather seat and tap it slightly to make it close tight. See that the flue is cleared of all dirt and rubbish. If there is a damper in the vent pipe, remove it.

When a water mixing chamber is used in a shower bath, it frequently happens that the cold water goes around and into the hot water pipe if the valves are left open, and the blame is put on the heater; close the valves. If reaction takes place, i. e., if the heater turns on the gas when a cold water faucet is closed, it can be overcome as follows: First, place a swing check valve on the hot water line leaving the heater, as near to the heater as possible. Second, replace the spring in the water valve with a heavier one. Third, severe cases of reaction, and rattling of coils, due to the water pump, can be overcome by putting an air chamber on the cold water line. This can be done by putting on three feet of two-inch pipe with an air-tight cap on the upper end. This cap should be soldered on, or air will leak out. Such an air chamber will take up the pulsations and the noise will cease.

An independent vent pipe should be run from the heater to the chimney. If impossible to secure a separate opening into the chimney, the vent pipe must be run into the other pipe at an angle, never straight into it.

Never go to any expense to make a heater stick until you learn what the water pressure is. If you find the pressure is too low to operate the heater, take it back at once, before it becomes unsalable. See that the gas line to the heater is large enough, and the meter the proper size. When you find the plunger is too loose, on account of the valve having become worn, and there is a leakage which prevents the valve from working properly, same can be remedied temporarily by wrapping candlewick or twine around the groove in the bearing of the plunger. To overcome the trouble permanently, an entire new valve body and plunger should be used. A new plunger alone will not overcome the trouble, since the inside of the valve body has also been worn and the new plunger will therefore not fit the old valve. The water preasure in a house is very much reduced if one or more of the water-closets are leaking. In such cases recommend their repair at once. When the gas at the main burner sputters and makes a cracking noise it is due to the flame being too sharp. This can be overcome by using a spud cap with a large orifice.

The destruction of copper coils is caused by the formation of sulphur dioxide, SO_2 and some SO_3, by combustion of the gas. While these do not attack the copper they form with moisture sulphuric acid, which is taken up by the condensed water and flows down the coils. The harder a heater is worked the more condensation and acid is formed with the consequent destruction of the coil. To remove lime from coils use commercial hydrochloric acid, from one part of acid and five of water, to one of acid and ten of water. Cork one end of the coil, fill it with the solution, and let it soak. Assist the action of the acid by gently tapping the coil with a wooden mallet. The solution can be used over and over again. Care should be taken not to have the solution too strong or it will destroy the copper. From 10 to 20 minutes is sufficient time. It is better to remove the solution a little sooner and if the lime is not completely loose, to try it again.

Supply of Hot Water at Various Pressures.—The following table gives the exact flow of hot water per minute through the Nos. 4, 6 and 8 low pressure heaters, under various pressures. When the pressure at the highest faucet is ascertained, a glance at the table will show how much hot water will be delivered per minute by each size heater at that pressure. Low pressure heaters are not made in sizes smaller than the No. 4.

Pressure.		Flow of Water Through Low Pressure Heaters Equipped with 5-Inch Water Valve and — Feet of Pipe in Service Line.								
		20 Feet ¾-Inch Water Pipe.			40 Feet ¾-Inch Water Pipe.			60 Feet ¾-Inch Water Pipe.		
In Lbs.	In Feet.	Gallons per Minute.			Gallons per Minute.			Gals. per Min.		
		No. 4.	No. 6.	No. 8.	No. 4.	No. 6.	No. 8.	No. 4.	No. 6.	No. 8.
3	6.9	1.0	1.4	1.9	0.9	1.25	1.7	0.8	1.1	1.55
4	9.2	2.0	2.3	2.6	1.85	2.1	2.4	1.7	1.9	2.15
5	11.6	2.3	3.8	3.8	2.15	3.45	3.6	2.05	3.25	3.35
6	13.8	3.0	4.3	4.4	2.9	4.0	4.2	2.8	3.75	4.0
7	16.2	3.6	4.7	4.8	3.45	4.4	4.6	3.25	4.15	4.45
8	18.5	3.9	5.6	5.7	3.8	5.45	5.5	3.65	4.8	5.1
9	21.0	4.6	5.8	6.1	4.45	5.6	5.75	4.3	5.1	5.45
10	23.0	5.0	6.5	6.8	4.9	6.05	6.4	4.75	5 65	6.0

Capacity of Heaters.—The following table gives the capacity per minute of the various sizes when certain raises in temperature are desired. For example, if the inflowing cold water is 70° and it is desired to raise it to 170°, a No. 4 heater will deliver 2.54 gallons per minute. Where high temperatures are required, a larger heater is necessary, and the flow must be cut down accordingly.

Size of Heaters.	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°
No. 2.....	2.68	2.20	1.85	1.60	1.42	1.27	1.15	1.04	0.95	0.88	0.81
No. 100.....	2.68	2.20	1.85	1.60	1.42	1.27	1.15	1.04	0.95	0.88	0.81
No. 3...	4.00	3.30	2 78	2.40	2.14	1.90	1.72	1.56	1.44	1.32	1.22
No. 200.....	4.00	3.30	2,78	2.40	2.14	1.90	1.72	1.56	1.44	1.32	1.22
No. 4.....	5.35	4.40	3.70	3.20	2.85	2.54	2.30	2.10	1.90	1.75	1.62
No. 300.....	5.35	4.40	3.70	3.20	2.85	2.54	2.30	2.10	1.90	1-75	1.62
No. 6	8.00	6.50	5.50	4.85	4.26	3.80	3.44	3.14	2.87	2.64	2.45
No. 400.....	8.00	6.50	5.50	4.85	4.26	3.80	3.44	3.14	2.87	2.64	2.45
No. 8.....	10.07	8.80	7.40	6.45	5.70	5.10	4.20	4.60	3.80	3.50	3.25
No. 500.....	10.07	8.80	7.40	6.45	5.70	5.10	4.20	4.60	3.80	3.50	3.25

THE report of business done by the New York Public Service Commission for October shows an increase in the number of new cases filed with the Commission. The Commission disposed of 76 formal cases during the month, while 87 new ones were submitted. This makes a total of 549 formal cases disposed of since March 16 last. 106 informal cases were filed with the Commission during the last month and final disposition reached in 129 old and new informal complaints. The total number of informal complaints disposed of since March 16, is 1,216.

Deep Water Pipe Laying.

In the JOURNAL of January 5th, page 14, is a description of the pipe joint developed for the Catskill Aqueduct cast-iron main across the Narrows, New York harbor, laid to supply water to Staten Island. These details of the work are from a report by the engineers of the Board of Water Supply of the City of New York:

The crossing has many of the usual difficulties encountered in laying submarine pipe, and in an exaggerated degree. The Narrows is the main entrance to New York harbor from the ocean; through it pass the largest steamships afloat, and very many craft of all kinds, making it one of the busiest channels in the world.

The pipe line will cross anchorage grounds for merchant vessels and ships of war, where the depth of water is now 30 feet, and dredging to about 30 feet below the harbor bottom for a length of nearly 300 feet is required.

Government regulations require that no refill shall be placed above El.—45, mean low water, and protection of the pipe requires about 8 feet of refill, so that the bottom of the pipe must be at least 56 feet below mean low water. This great depth made it advisable to do as much of the work on the surface as possible, and therefore the continuous method of laying pipe by means of a cradle was preferred to any method of lowering the pipe in sections and joining them together on the bottom.

Experiments were conducted prior to letting the contract with a view to developing a joint which would not require calking under water. Various alloys of lead with tin and antimony were tried with a view to developing a nonshrinking joint filler, but without success. Joints calked with lead wool proved tight but not flexible.

It was decided to attempt to calk the entire joint through mechanical means by forcing lead into the back of the joint after pouring. Sixteen holes were bored and tapped through the bell. A paste made of flake graphite and anti-friction compound was put into these holes and forced into the joint by screwing in tap bolts or gib screws. Lead plugs ½ inch in diameter and 1 inch long were then screwed down, about 7 pellets per hole being used, amounting to 9 pounds of lead per joint. The joint proved to be tight and flexible under ordinary conditions and the promise of ultimate success was sufficient to proceed with the letting of the contract. The contract was awarded, March 2, to the Merritt & Chapman Derrick and Wrecking Co., at an estimated total cost of about $1,000,000. There were still extraordinary conditions to be met and some details to be worked out. Accordingly, through the co-operation of the contractor, experiments were resumed after the letting.

In addition to tightness and flexibility it was desired that the joint have the greatest possible strength against longitudinal pull. The ordinary lead joint, even though uncalked, becomes tight when subjected to a longitudinal strain, but when the strain is released the leakage is worse than before. On account of the length of the Narrows siphon, sag could not be relied upon to tighten the joints, and, in addition, the stress and movements due to changes of temperature had to be considered. With a view to increasing the longitudinal strength the gib-screw holes were moved with the idea of concentrating the lead at the greatest diameter of the bell. This was not successful, as the lead tended to flow out of the face of the joint instead of filling it up. Finally, the second set of gib-screw holes was added, as in Fig. 1; this joint proved a complete success and is the one being used.

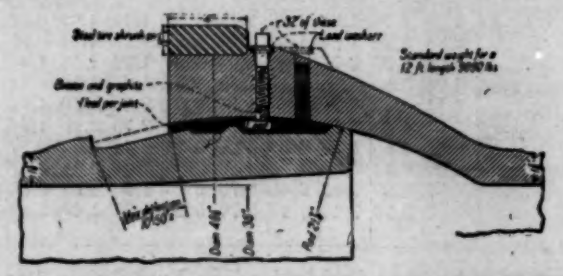


Fig. 1.

The procedure of pipe jointing on the deck of the scow is as follows: The inside of the bell is coated with graphite. The spigot of the next pipe is inserted and properly centered and the joint poured, using about 300 pounds of lead. Lead pellets $\frac{3}{16}$ inch in diameter by 1¼ inch long are forced in by compressed air, three in each back hole, three in each front hole, and then one in each back hole, using from 20 to 22 pounds of lead in all.

A mixture of grease with 10 per cent. graphite is forced in each hole, and the holes plugged with tap bolts and lead washers. The joint is deflected 5° and tested under hydrostatic pressure of 100 pounds per square inch before launching from the scow.

The pipe-laying scow is 40 feet by 125 feet, and is held in position by 10 anchors. It carries the 70-ton derrick for handling pipe and for auxiliary operating. At the beginning of the work it supported the pipe-laying cradle or skidway. The latter is now carried by cables running over a trunnion in front of the scow. The cradle is of structural steel and resembles a through truss, curved in the vertical plane. It is 168 feet long, 8 feet wide and 10 feet high, and weighs nearly 60 tons. The pipe is held in place on it by three guides.

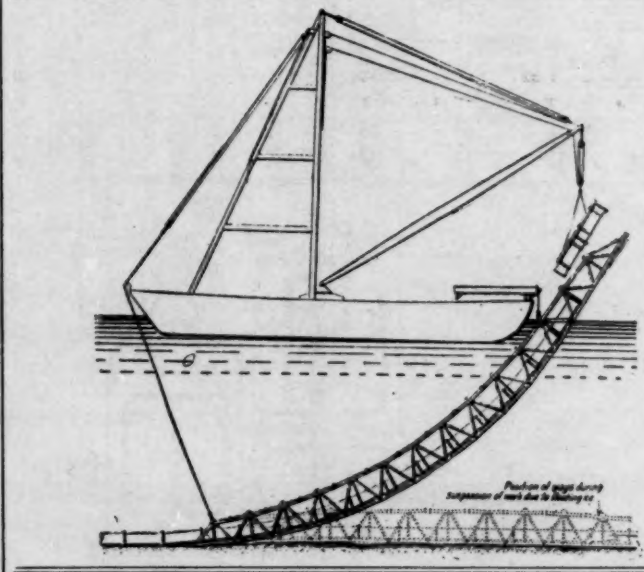


Fig. 2.

As soon as a joint is completed and painted the skid way is drawn ahead and the finished pipe at the lower end slips off to the bottom of the dredged trench. The skidway is then ready to receive another length.

Possibilities of Auxiliary House Heating by Gas.[1]

[By MR. W. H. SCHOFIELD.]

This question involves and invites a greater scope of discussion than the topic implies, and should include the question of supplying supplemental and principal heat as well. Although the distinction between auxiliary and supplemental heat is generally understood, it is well to refresh our minds. Auxiliary heating implies and is generally understood to be a separate system of supplying heat when the principal heat is not required; while supplemental heating is understood to indicate a separate system to be used in supplying additional heat when the central or principal source is in operation. As a gas heating device performs both these functions, its value and importance in the home is more appreciated.

As to supplying the principal heat from gas, climatic conditions and local environment are the factors that determine the extent and possibilities of its use. In the principal cities of Great Britain, and many of the large cities in Europe, gas is rapidly displacing other fuel in supply heat for the home. The evolution is very marked in London, where gas heating appliances (referred to over there as "gas fires") are rapidly displacing coal fires, and are in common use in almost every house to such an extent that the aggravating London smoke has been very much reduced. The prevailing types of gas fires used there, however, are far inferior to the appliances used in America; in fact the English type of heater, *i. e.*, the grate filled with asbestos balls and using a blue flame was discarded in this country years ago.

The question of supplying supplemental and auxiliary heat in the American home has not received the serious consideration of gas companies until the last year or two. The possibilities of this field

1. Paper read at the Fall Meeting, New Jersey State Gas Association.

are unlimited, and it can be made one of the most important for gas consumption. The cause of the slow growth in sale of gas heating appliances in this country is largely the inferior quality of the devices. Gas companies have been content to sell anything that would burn gas, with little regard for the efficiency or merit of the device. The public have been dissatisfied and justly prejudiced against gas heating appliances through their inferior quality and inefficiency. The gas heating appliance that will win back public confidence must have decided improvements over former types in regard to appearance, economy in operation and sanitary perfection. The heating appliance that burns the least gas per hour will burn the most gas per year. The heater that throws off no offensive odors will be used the most hours.

The house heating problem has greater possibilities than any other in the sale of gas fuel, and the question is now receiving the serious consideration of some of our larger gas companies; and when the same systematic work is done in the introduction and sale of gas heating appliances as is employed in the sale of gas lights and gas ranges, results of extensive proportion will be realized. In order that you may see the possibilities, I know a prominent manufacturer of high grade heaters to have been requested to quote on 360 gas heating appliances for an apartment house in New York city. This apartment house now has 180 apartments with 180 coal and 180 gas stoves. It is estimated the consumption of gas for heating will amount to 900,000 cubic feet per month or 5,000,000 for 6 months.

There are distinct and positive advantages to be derived from the use of gas in heating the home that are strong arguments in favor of its use, and prove important factors in the development of this reliable field. First in importance is the positive and quick service. Next and probably of equal importance is the cleanliness compared with the coal and wood fires extensively used in supplying auxiliary and supplemental heat. The handling of coal and ashes not only creates dirt and trouble, but requires attention and "watchful waiting" for the spark or coal that snaps out on the carpet or rug.

The best evidence of the practical value of devices is often obtained from the purchasers or users. The following endorsement of the practical value of a modern high grade fireplace heater, not only shows the practical advantages derived, but also that a good gas heating device will win-over a man who has been prejudiced by experience with inferior devices. As an example, I quote the following: "About two years ago I purchased one of your fireplace heaters which was installed in my dining-room. We have in the living room an open fireplace for burning wood. My wife and I take frequent auto rides after dinner, during the early Fall and late Spring, and often come home chilled; and it has been our practice to start a fire in the open fireplace so we could get warmed up before retiring. We now use the dining-room gas heater altogether because it is no trouble and it gets busy right away, and when we are through with it, we turn it out and that ends it; in fact this heater has converted our dining-room into a living-room." There is a lot of sentimental poetry written about open fireplaces, but there has been a lot of faults discovered in its practical use. If you have one in your home, take a look at it when not lighted, and be frank and honest, and you will say it is the most unsightly thing in the house.

With your indulgence I want to relate an experience of a practical demonstration of the impracticability of open wood-fires. My wife and I were guests of a friend living in one of the prominent suburbs of Brooklyn. After tea the husband thought it a little chilly and suggested having a fire in the fireplace. The maid was absent, so husband started for the cellar. We heard him chopping and splitting, and after a while he returned with an armful of wood. Wifey got him a piece of paper to lay the wood on so he would not soil the carpet; he then got another piece of paper and laid on the kindling, and soon had a roaring fire, and jokingly remarked, "that beats all your gas fires." The subject of fires was soon dropped, and other matters were the topic of conversation, when suddenly someone exclaimed, "I smell something burning," and it was discovered that a spark had snapped into the room and burned a hole as large as a half dollar through the new imported rug. Wifey yelled, "put that screen on." Husband said, "no use now, the wood has already burned out," and wifey remarked, "you might as well not have lighted it in the first place," and added, "if you had tried to give a practical demonstration of the impractical, you surely have made a perfect success. I will simply add for the benefit of the company, that if you were going to be here in the morning and see yours truly with a dusting cap on her head trying to take up the ashes without having them fly all over the room, which can't be done, you would then understand why I dislike wood fires." If a customer has more than one fireplace in his house, and is strong on wood fires, try to persuade him to equip one with a gas heating appliance. If you succeed, and give him a device that is odorless and economical to operate, you are quite certain of getting his order for the others, or, at least, for all but one.

In many of the better class of residences built prior to 1900, marble mantels were used quite extensively. The average house has two or three, many have four or five, and some have as many as seven or eight. Most of these have never been equipped with any kind of heating appliance, although some have coal grates, and, once in a while, a gas log or asbestos back heater. It is estimated there are 50,000 of these mantels in Greater New York, and the same conditions exist in Jersey City, Newark, Trenton, Camden, and other New Jersey cities. In addition to the foregoing, if you will think of the number of fireplace openings in your territory that, for diverse reasons, are not utilized for supplying heat in the home, you will find that some are equipped, but many are not used. "There is a reason," and here is an opportunity for placing a good type of gas-heating appliance. It may be interesting, in this connection, to state that a large manufacturer of modern gas-heating appliances made a special effort to ascertain the concensus of opinion of the people visited by his salesmen as to the cause of their dissatisfaction with the appliances they had installed in their homes, and invariably they expressed their views as follows: "They burn too much gas, and, after they have been lighted a little while, they throw off such a disagreeable odor that we cannot stand it."

We must bear in mind that the heater that "makes good" in the home is the heater to sell. If you select the best, and then push the sale of that heater until you get fifteen or twenty into good homes, the heater will "make good" and bring business to your office. The season for supplying auxiliary and supplemental heat in the home is at hand. An active canvass and an intelligent presentation of the superior merits of the modern gas heater is certain to bring satisfactory results and lay the foundation for the largest possible market for the sale of gas fuel.

New Methods and Appliances.

PORTABLE ELEVATORS AND LOADERS.—For loading loose materials such as coal, sand, stone, gravel, oxide, etc., from ground storage to wagons or platforms, various types of electrically operated portable loaders have been developed. Fig. 1 is a diagram of one designed for anthracite coal, and includes a shaking screen at the head. At the foot of the elevator is another conveyor for feeding the coal to the buckets. The elevator consists of double-strand chains with malleable-iron buckets, 16 inches by 6.5 inches. The total weight of the apparatus is 2,700 pounds, and it is operated by a 3 horse power motor. For use in yards where it is necessary to move the loader under a shed or from one side of a low trestle to the other, the collapsible, bituminous coal loader shown in Fig. 2 has been designed. The bucket-elevator part is pivoted near the middle, and by turning a crank which operates a worm-gear the foot of the machine

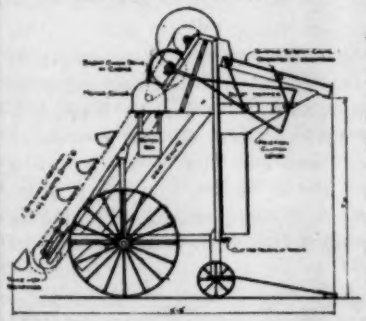


Fig. 1.—Diagram of Construction.

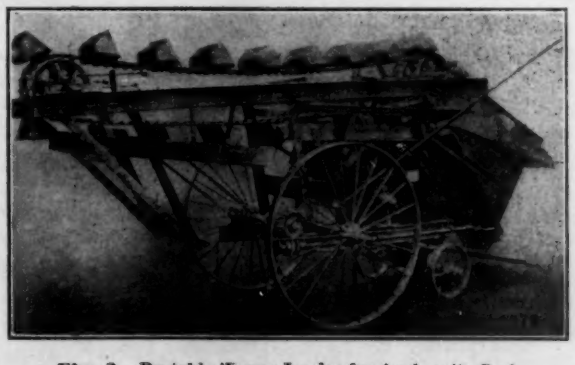


Fig. 2.—Portable Wagon Loader for Anchracite Coal.

is raised and the head lowered, reducing the height so that it will pass under the obstruction. The total weight of this loader is 4,900 pounds, and it is operated by a 5-horse power motor.

THE CLINKERING OF COAL.—One of the most troublesome features in the combustion of coal is due to the production of clinker. This influences the rate of combustion and the cost of maintenance, especially with automatic stokers. A coal may clinker so readily under certain conditions that it becomes unfit for use, irrespective of its fuel value. It is, therefore, of the greatest importance to know whether a coal will clinker under tbe conditions for which it is required. The determination of the clinkering properties of a coal—that is, whether its ash will fuse at a low temperature—has been carried out in several ways; and many authorities have considered that an analysis of the ash, or determination of the iron in the ash, or of the sulphur in the coal, would furnish the information desired. But analyses of the ash, together with fusing temperature determinations on a wide range of coals, show that no conclusions can be drawn from a chemical analysis. Some coals have ash of like iron contents and varying fusion temperature; others have ash of like fusion temperature and variable iron content. It would appear, therefore, that there is no relation between the percentage of the various constituents of the ash and the fusing temperature. Hence a chemical analysis is of no value for arriving at a judgment as to the clinkering quality. The fusion temperature of the ash ought, therefore, to displace the sulphur determination in coals used for steaming purposes, and this change will readily show the fallacy of buying and selling coal on an analysis basis, where specifications are used containing sulphur tables penalizing beyond a certain guaranteed amount of sulphur. It has been common practice to place 1.5 per cent. of sulphur as a limit, and to penalize the seller as much as 4 cents per ton for every 0.25 per cent. of sulphur above 1.50 per cent. The injustice of this practice is evident, as it often happens that coals with a high sulphur content are extremely high in heat value, and do not clinker readily. Since the sulphur has no appreciable effect upon the metallic parts of the furnace, it need not be considered in the selection of a coal for steaming purposes. To arrive at the value of a coal for this purpose it is, therefore, just as essential to make the fusion test of the ash as it is to make the calorimetric determination. If these two determinations are made, an explanation is readily found as to why two coals of apparently like proximate analyses give entirely different evaporation when fired under like conditions.

STRENGTH OF GLUE.—A series of tests to determine the strength of glue were made by Messrs. O. Linder and E. C. Frost, and reported to the recent meeting of the American Society for Testing Materials. The results show a strength of from 1,100 to 1,950 pounds per square inch for a glue made of 1 part dry glue and 3 parts water, and a strength of 60 to 70 per cent. of the above figures for a 1:5 glue. Prolonged heating lowers the strength of the glue. Glue solutions heated to 150° F. for 20 hours showed a loss of 30 to 45 per cent. in strength.

Recent Patent Issues.

Prepared for the AMERICAN GAS LIGHT JOURNAL by ROYAL E. BURNHAM, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,114,979. Gas Producer. C. M. Garland, Chicago, Ills.
1,114,984. Gas Generator. H. W. Hamilton, Indianapolis, Ind., assignor to Ham-Meix Mfg. Co., same place.
1,115,065. Apparatus for the Manufacture of Water Gas. A. G. Glasgow, Richmond, Va., assignor to the United Gas Improvement Co., Philadelphia, Pa.
1,115,200. Poking Hole for Suction Gas Producers. P. T. Houston, London, England.
1,115,255. Safety Gas Regulator. J. C. Reynolds, Bixford, Pa.
1,115,268. Gas Generator. C. Akerlund, Atlanta, Ga., assignor to Standard Gas Power Co., same place.
1,115,392. Process of Making Gas, J. N. Carrey, St. Louis, Mo.
1,115,595. Gas Burner. A. B. Shaw, West Medford, Mass.
1,115,765. Gas Stove. J. W. Ashbaugh, Bremem, O.
1,115,804. Gas Producer. C. M. Garland, Chicago, Ills.
1,115,847. Gas Fixture. H. Lyon, Gloucester City, N. J., assignor to Welsbach Co., same place.
1,116,131. Gas Producer. P. G. Schmidt, Olympia, Wash.
1,116,216. Process for Producing Gas from Bituminous Fuel. O. C. Berry, Glendale, O.

Items of Interest
FROM VARIOUS LOCALITIES.

KALAMAZOO, MICH., authorities have written to Mr. William Newbigging with the idea of engaging him to come to America and act as their expert in the gas rate inquiry. He has sent them estimates covering plants fully equipped with the latest improved machinery for efficient manufacture, omitting the cost of sites and without the necessary distribution mains. A fully equipped gas works with a capacity of 400,000,000 cubic feet of gas a year, according to Newbigging's estimate, would cost approximately £139,000 ($667,000). A gas works capable of producing 500,000,000 cubic feet a year would cost £170,000 ($810,000), while a 600,000,000 cubic foot plant would cost £200,000 ($960,000).

THE Northern Central Gas Company, Milton, Pa., has completed the line of pipes beneath Main and Montgomery streets, the newly paved street in the borough of Montgomery. Service extensions have been run to the curb, and all connecting links for general distribution and the main feed line have been placed wherever the pavement covers. A connecting line of 1,200 feet is being placed across the Susquehanna river, to connect with Watsontown. The connecting link, it is expected will be laid so that Montgomery will be furnished with gas from Milton next spring.

GEORGE B. TRIPP, who has been in charge as Vice-President and General Manager of the Harrisburg Light and Power Co., a subsidiary of United Gas and Electric Corporation, has been transferred to New York and made operating executive of the various companies controlled by the latter corporation. Mr. Tripp has been connected with a number of large public utility corporations at various times and each change he has made has been in the way of promotion.

HERE is a popular utility: "The Hartford (Conn.) City Gas Light Company was incorporated in 1840 with a capital stock of $100,000. At present it is supplying gas not only to Hartford proper, but to the towns of West Hartford, East Hartford and Wethersfield, representing a combined population of something over 150,000, and its capital stock is now $2,000,000. The combined company has made constant improvements in equipment and service, one of the latest additions being a 2,000,000 foot holder, one of five which the company now has at its command, the plant at the present time having a daily capacity of 5,000,000 cubic feet. The plant proper is situated two blocks from the new City Hall, enjoys adequate railroad and river shipping facilities, and its large building adds materially to the imposing sky-line of Hartford. The distribution of gas is taken care of by three large main trunk lines, laid out in such a manner that the city is divided into four sections, thereby insuring uniform pressure and service. At the present time the distribution system consists of a little over 150 miles of main, and there are 26,222 meters in use. The growing demand for the company's product and its popularity may be grasped when it is considered that there are 17,142 gas ranges, 7,464 gas water heaters and 2,558 gas arcs in use. The amount of gas used for industrial purposes is constantly growing, as there is hardly an industry in Hartford and vicinity, which has not availed itself of the added efficiency to be secured by using gas appliances in manufacturing. The service rendered the public is second to none. The organization is divided into departments, each supervised by an expert whose duty it is to see that his particular department is at all times ready to serve the public and render the most satisfactory service possible. The heads of these departments meet together at frequent intervals with a view of interchanging ideas that greater efficiency may be secured for the patrons of the company; it being the earnest desire of the officers of the company that its patrons receive prompt attention to all of their requirements."

THE municipal gas plant at Paulsboro, N. J., is forced to increase its capacity to take care of the new customers added the past few months.

THE Northern Central Gas Company will get the contract for the gas lighting of Williamsport, Pa. An ordinance has been prepared awarding the contract to the company at its bid of $22.50 for a seventy candle power Welsbach light per year. The city will maintain approximately the same number of gas lights that it has at the present time. The contract is for ten years.

HOLYOKE, Mass., has been put on the map of municipal plants by the demonstration given at the city hall, as men from similar plants in other cities have been there, seen what Holyoke has done, and gone home resolved to try and give similar affairs in their home cities. They admit that it will be difficult to equal the Holyoke demonstration.

AFTER an illness of six months of a complication of diseases, William K. Stratton, who had made his home in Haverhill, Mass., since 1874, died there last week, aged 77 years. Mr. Stratton was born in Trenton, N. J., April 12, 1838. In his youth he located in Philadelphia, where he learned the business of gasmaking under his uncles, the Stratton Bros., who were engaged in the business in that city. Later he removed to New York city for a few years, and then went to Exeter, N. H., where he filled the position of Superintendent of the Exeter Gas Company plant for several years. In 1874 Mr. Stratton located in Haverhill, becoming Superintendent of the Haverhill Gas Light Company, in which position he continued until the change in ownership in 1898, when he retired from an active business life. For several years he was one of the managing Directors of the Haverhill Gas Light Company, and was an active member of the New England Association of Gas Engineers. Mr. Stratton is survived by two daughters, who reside in Haverhill, and three sisters in New York.

ANOTHER gas company operating in New Bern, N. C., in competition with the one now doing business there is a strong probability, judging from action taken by the Aldermen last week. A letter was received from a Philadelphia concern asking for a franchise for the installing of a gas system.

THE Lynn (Mass.) Gas and Electric Company has taken out a permit for the erectionof a four-lift gas holder, to be constructed by the Bartlett-Hayward Comphny.

"H. T. C.," WRITES that the Fowler (Cal.) Gas Company plans extensive additions to its plant, and will extend mains and make other improvements with the $15,000 bond issue permitted at a recent hearing of the State Railroad Commission. A service has been run to Fowler Waterworks, and that plant will hereafter use gas for its engines. The plant has not been sold to the city as was indicated by the filing of a deed of trust Thursday in Fresno in the name of A. D. Wilson, one of the city trustees. Mr. Wilson, in the papers in question, is acting as trustee for the bondholders, who have bought, or will buy the bonds in question.

THE Financial and Economic Annual of Japan gives the figures of the growth of gas and electric companies since 1907. In that year, in Japan, electric companies supplied 859,143 electric lights. In 1912, the latest for which statistics are given, the total had risen to 4,499,627. Gas lights supplied to dwellings in 1907 were 249,623, while in 1912 they numbered 1,205,773.

TEN miles of gas mains with the entire plant to be in operation within 18 months after the time of the granting of the franchise are two of the stipulations under which the American Construction Co. of Newton, Ia., is asking for a 30-year franchise at Muskegon Heights, Mich. The gas rate to be $1.25 per 1,000 cubic feet.

THE gas department of the Rochester (N. Y.) Railway and Light Company is laying several stretches of gas main and finishing up as far as practical work requiring excavations before cold weather. The sections of mains now being laid include links in St. Stanislaus street, from North street, east; Dayton street, beginning at Hudson avenue; Linden street, beginning at Goodman street; Avery street, from Emerson street, and other sections in Fulsom and Burrows streets and in Merchants road.

A LOCAL paper says that the Hartford Gas Light Company has transformed its plant to such an extent that the management now declares it to be the equal of any in the country. This work of changing the equipment and the introduction of automatic machinery has been continuing for some months, and with two objects in view. One reason for the change was the fact that the population of the city required larger facilities in the plant and the other was that the company wished to be independent of all hitherto controlling conditions, and to be able to produce gas even though the supply of coal, a requisite for gas production, ran short, by keeping thousands of tons of coal in reserve and by utilizing by means of the new apparatus the production of coal gas, and the by-pro duct of coke. In the case of a shortage of coal this c oke could be used. The addition of a coal gas unit has increased the manufacturing plant. This has a daily capacity of 1,000,000 cubic feet. The entire plant is so arranged that the water gas and coal gas are treated separately so as to give uniform results. The principal advantages are sp eed and economy.

MR. EDMUND B. MOONEY, Manager of the new bu siness department of the Brockton (Mass.) Gas Light Co., is suffering from injuries to his right foot, received in an attempt to kick a football.

THE Columbus (O.) Gas and Fuel Company rece ived election returns by a special wire at the offices of the company. Employees and their friends were entertained there during the evening, President B. G. Dawes having sent apples and cider from his farm near Marietta, for the occasion. Mr. Dawes says that the Washington County crop of apples is the greatest in years, both in quantity and quality.

MR. C. B. MCKINNEY, General Superintondent of the Gulf Gas Company, Biloxi, Miss., who has served the company for the past three years, has resigned.

DR. W. W. JOHNSON has resigned as Superintende nt of the Goshen (Ind.) Gas Company and will locate in New York, where he has a business proposition under consideration. Dr. Johnson has been in the employ of the Goshen Gas Company for ten years, and has been very successful as a manager. He has held the con fidence and good will of the public and gas company, and has prospered and profitted accordingly.

MR. JOHN R. ELLIS, manager of The Greenville (Tex.) Gas Company, has resigned his position with that company as of October 1. Mr. W. A. Cullinane, of St. Louis, has been appointed to succeed him.

MUCH gas and electric current used in the lighting of public buildings is wasted. Commissioner Williams of the Department of Water Supply, Gas and Electricity of New York City, makes this charge, in connection with a statement directed to city officials having charge of public buildings, requesting them to reduce the waste of light. "Gas, electric light and power cost money," he says. "To waste them is to waste money. This department lacks the machinery to check the waste and must rely upon your co-operation to accomplish the desired end. The appropriations for 1914 for the lighting of public buildings reached $1,145,886. A saving of at least 15 per cent. can be effected if all concerned will co-operate."

MR. H. R. BALSAM, Chefe des Seccoes de Canalisacao E Emissao, Gas Department of the Rio Janeiro Tramway, Light and Power Company, is enjoying a 4 years' accumulation of vacation. It took him a month to get to New York, and now, after about that time looking around he is on his way to the Pacific Coast, to visit relatives. He will probably start back to Rio about February 1st. Mr. Balsam brought news of the good health of Dr. Harrup and our old friend, L. J. Carder.

AS AN answer to the petitions to the Winona (Minn.) City Council asking for additional lighting in the residence district, the Winona Gas Light and Coke Company has installed a number of new lights in the middle of the blocks, which aid considerably in brightening the streets at night. This year the city called for a larger number of lights, both electric and gas, than were in operation last year, and they were distributed where most needed. There has been a tendency to supplant some of the larger lights with smaller ones, putting in two or three small lights where one large one was taken out. This policy distributes the light better, although in one spot the light may not be so strong.

FORT MADISON, IA., is growing rapidly toward the west end, and the Fort Madison Gas Light Company finds it necessary to make at least 2½ miles of main extensions this fall to properly cover the new development. The pipe is already on the ground, and Manager Moffett is hurrying the laying in order to get as much as possible installed before heavy freezing.

Utilities Commission News.

PAYMENT FOR MAIN EXTENSIONS.—The Public Utilities Commission of New Jersey held a meeting in Camden to hear arguments between citizens and the two Camden gas companies, as to the cost of requested extension of gas mains. In all instances an inspector of the Commission had recommended a compromise, which was unsatisfactory to the companies. The first case was that of Charles Warfield, who wanted a main extended 222 feet to reach his home. The gas company asked $90 for the work; the inspector suggested that Warfield guarantee to pay $47 a year until other users of gas appear as fair reimbursement for the company's investment. The company refused to agree to this proposition, saying that $47 was not enough. The inspector proposed a guaranteed payment of $65 a year for laying a main 414 feet to a Camden suburb. This was also refused by the company. It was recommended that George B. Shaner, of Palmyra, guarantee to use gas to the value of $59 a year for 2 years to get the main extended 600 feet to reach his house. The company was dissatisfied with this. Valentine Batchelor was willing to give a guarantee that he and six other prospective customers would pay a minimum of $206 per annum for having a main moved 1,100 feet to reach their homes in Berlin. The company would not agree to this either.

BALTIMORE QUESTIONS.—In answering the questions submitted by the Public Service Commission following the recent conference on gas standards, the Consolidated Gas, Electric Light and Power Company calls attention to the fact that 11 States have adopted a single standard for gas based on heating value, and also by inference argues against any change in present conditions.

The company says that the establishing by the Commission of any heating standard in excess of 570 B. T. U.'s would put an increased burden on the company when making gas without the mixing of the coke oven gas from Sparrows Point, and that the manufactured gas alone, if a standard as high as 600 B. T. U.'s is established, would have 21.5-candle power, whereas 20 is all that is now required. It is also stated that if the standard is set at 570 B. T. U.'s in lieu of the 20-candle power now required, the average candle power would, with the normal output of the Sparrows Point gas, be only 18.5.

The answer filed asserts that the tests of heating value made by the company vary greatly from the tests made by the Commission, the latter uniformly giving a higher heating value than the company's experts report. No explanation of this variance is offered nor was it explained by the Commission.

The company states that the cost of gas at the holder is 27 cents per 1,000 cubic feet, but that other charges bring it up to 52 cents when it reaches the consumer.

The Commission will in a few days prepare a set of rules for the manufacture of gas, but will leave the question of standard of quality open until another conference is held.

INDIANAPOLIS LIGHTING SITUATION.—The Indianapolis electric situation is considerably involved. The Merchants' Heat and Light Company has been successful in obtaining a contract with the city to light its streets for the next ten years. The Indianapolis Light and Heat Company has had the contract for the last ten years.

Meanwhile, investigations as to rates and service of the companies have been proceeding under the Public Service Commission with complications at almost every step. Suits and petitions have been filed, and a decision from the Commission relative to rates is expected at any time.

The Merchants' company has surrended its franchise to the Commission, and last week the Indianapolis company surrended to the Commission all franchise privileges it might have relating to rate-making power or service. The surrender was in line with a recent surrender to the Commission of the rate making power of the Citizens Gas Company of Indianapolis, when the latter sought to merge with the Indianapolis Gas Company. Certain contractual rights existing in the lighting franchise between the city and the company made it improper to surrender the franchise of the company, its officers believed, and the Commission therefore accepted the incomplete surrender offered.

Shortly after the Merchants' company, which has expended $130,000 in extending its equipment to begin operations next April on its street lighting contract, petitioned the Commission for authority to issue bonds to the value of 80 per cent. of expenditures for new construction. The Commission refused to allow the issue in full, withholding its approval of $28,000 of the amount on the ground that this amount represents duplication of property of the Indianapolis Light and Heat Company. The case was taken to the courts.

Financial Notes.

THE report of the gross earnings of the Pawtucket (R. I.) Gas Company for the quarter ending September 30, filed in the office of the City Treasurer, give the gross earnings of the company for this period as $65,399.89, and on this amount the city will receive 2 per cent., or $1,308.

MR. C. L. HOLMAN, President of the Laclede Gas Light Company, doubts the truth of press reports from New York to the effect that $69,000 of forged Laclede Gas common stock has been put into circulation. "We did not receive any notice from the Guarantee Trust Company, our transfer agent," said Mr. Holman. "I believe the company would have telegraphed us if it were true." Press despatches said that the stock books were in charge of transfer clerks. The blank certificates bore the signature of the registrars, and all that was necessary was to fill out the blank for the number of shares, and affix the signature of an officer of the company. Mr. Holman said that if it is true the worthless certificates have been issued, they will be detected when dividends are paid. In any event, the Laclede company will not lose anything because of the situation.

WILLIAM P. BONBRIGHT & Co., are offering in Boston a new issue of $450,000 Louisville Gas and Electric Company 6 per cent. notes, due April, 1917, on a 7 per cent. basis. The bankers are meeting with a good demand from investors at this yield.

THE stockholders of the Fall River Gas Works Company, at special meeting, authorized a petition to the Massachusetts gas and electric light commission for right to issue a sufficient number of additional shares of capital stock to yield approximately $688,000. It is proposed to petition for authority to issue 3,622 shares at $190 per share, the proceeds to be used to retire floating debt.

THE annual report of the Consumers' Gas Co., of Toronto, shows good improvement over the previous year. Net earnings of $944,949 represent an increase over the previous year of $102,968, while the capital stock increased only by $157,000 although the premium paid on it amounted to $97,262. The company has had to borrow capital on a much larger scale to carry out extensions.

THE Western States Gas and Electric Company reports for the 12 months ended Sept. 30, last: Gross, $1,096,734; net, $495,779, and surplus after charges and dividends, $71,793.

AT the recent American Bankers' Association convention, Mr. A. M. Harris, of Harris, Forbes & Company, New York, presented a paper on "Savings Bank Bonds in the Light of Recent Developments," in which he said: "To my mind, one of the most significant developments in savings-bank bond requirements is the recognition of public service corporation bonds. While telephone and street railway are undoubtedly excellent additions, there is warrant for the assertion that they do not comprise exclusively the best in the public utility field. The principal other classes of public service corporations are gas, electric light and power companies. The best representatives of these public utilities furnish a most stable basis of security. Practically unaffected by industrial depression, and practically free from the ill effects of competition by the fact of their being natural monopolies, the leading public utilities of this country have grown rapidly in favor with conservative investors during the last ten years. Banks other than savings institutions, as well as private investors, are now among the largest purchasers of the bonds of such companies. Their admission into the savings bank eligibility class is, therefore, a natural step."

THE trustees of the Massachusetts Gas Companies have declared the regular semi-annual dividend of $2 per share on the preferred stock, payable December 1. The transfer books close November 14 and reopen December 1.

THE Consolidated Gas, Electric Light and Power Company, of Baltimore, in a letter to holders of its preferred stock, urges them to exchange the 6 per cent. preferred, share for share, for the 7 per cent. common stock before expiration of the conversion privilege December 19. Preferred stock so exchanged will rank with the existing common stock for the 1¾ per cent. common dividend payable January 1, 1915. The retirement of all the preferred will enable the company to carry out its program of financing by the sale of debentures. Under provisions of the issue of the preferred stock, no lien can be put ahead of it, and as a result the company has been handicapped by inability to finance by the sale of prior lien securities.